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CHEMICAL & METALLURGICAL ENGINEERING



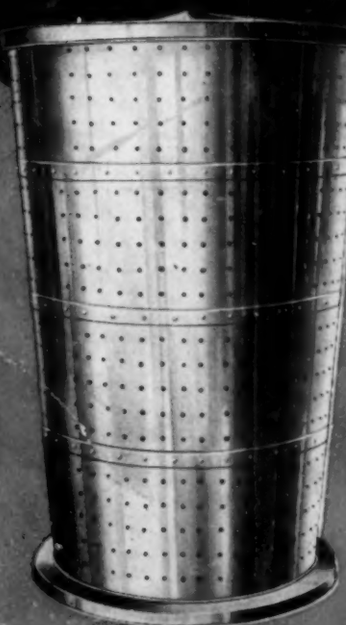
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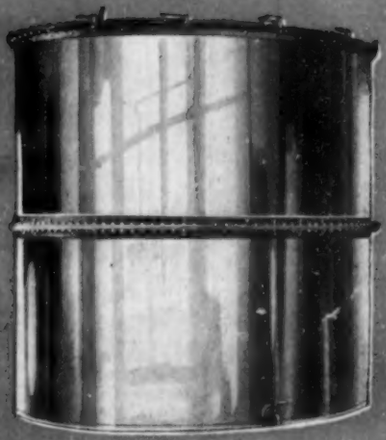
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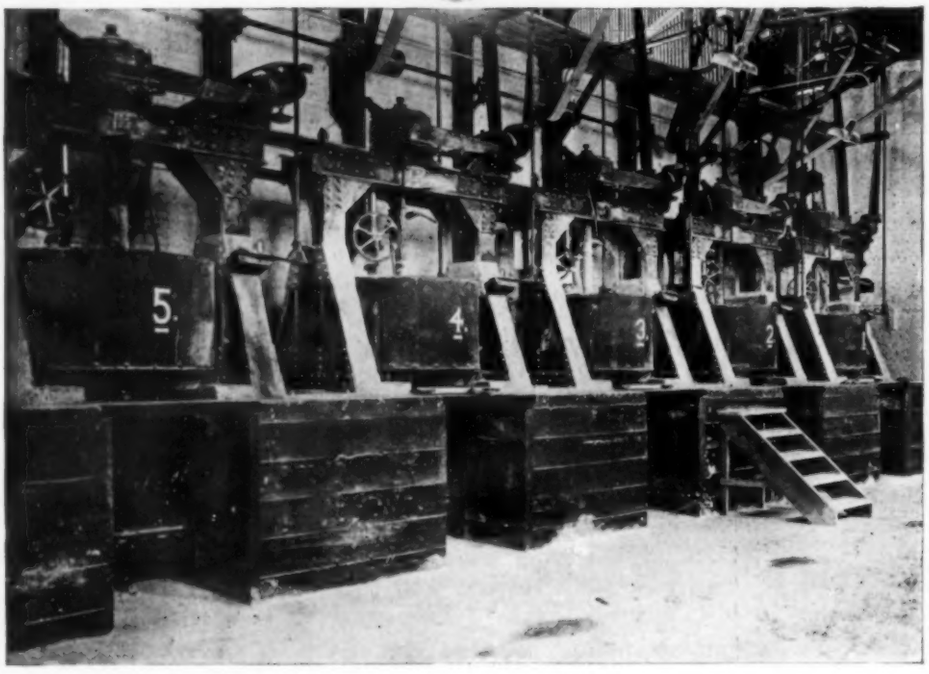


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Volume 34 *Number* 5

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Chemical & Metallurgical Engineering is the successor to *Metallurgical & Chemical Engineering*, which, in turn, was a consolidation of *Electrochemical & Metallurgical Industry* and *Iron & Steel Magazine*. The magazine was originally founded as *Electrochemical Industry*.

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McGRAW-HILL PUBLISHING COMPANY, INC., Tenth Avenue at 36th Street, NEW YORK, N. Y.
New York District Office, 285 Madison Avenue
Cable Address: "Machinist, N. Y."

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Member Audit Bureau of Circulations

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Electrical World — Electrical Merchandising
Radio Retailing — Engineering and Mining Journal
Electrical West
(Published in San Francisco)
American Machinist—European Edition
(Published in London)

Number of Copies Printed This Issue, 13,050

The annual subscription rate is $3 in the United States, Canada, Mexico, Alaska, Hawaii, the Philippines, Porto Rico, Canal Zone, Cuba, Honduras, Nicaragua, Dominican Republic, Salvador, Peru, Colombia, Bolivia, Ecuador, Argentina, Panama, Brazil, Uruguay, Costa Rica, Guatemala, Paraguay, Chile, Haiti and Spain. Extra foreign postage in other countries $2 (total, $5, or 21 shillings). Single copy 35c. Change of address—When change of address is ordered the *new* and the *old* address must be given. Notice must be received at least ten days before change takes place.

Copyright, 1927, by McGraw-Hill Publishing Company, Inc.
Published monthly. Entered as second-class matter July 13, 1918, at the Post Office at New York, N. Y., under the act of March 3, 1879. Printed in U. S. A.

Member Associated Business Papers, Inc.

Searchlight Section, 200 to 206; Professional Directory, 198-199; Ready Reference, 218-220-222-224; Alphabetical Index, 226

The final cost of oxwelding

The success of the oxy-acetylene process and the remarkable growth in the extent and variety of its applications are convincing testimony that oxwelding is economically sound.

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CHEMICAL & METALLURGICAL ENGINEERING

H. C. PARMELEE
Editor

Volume 34 — New York, May, 1927 — Number 5

Psychology and Employment

STUDIES in psychology are offering new solutions for the old problem of "square pegs" and "round holes" in employment. The language is different—more scientific and less homely. But in such terms as "introvert," "extrovert" and "ambivert" one senses a differentiation in types of men; and in the expression "personal inventory," a method of determining human qualities and characteristics in terms of adaptability to specific employment. The probability of fitting the individual to the niche he can fill best is apparently enhanced by such studies as those of Dr. Donald A. Laird of Colgate University, author of "Psychology of Selecting Men."

THE subject holds direct interest for men of scientific and engineering training, particularly in chemistry and chemical engineering. These vocations offer opportunities sufficiently diverse in character and requirements to warrant careful study and attention by the individual, to see, first, that he certainly avoids the path of failure and, second, that he starts, at least, toward a goal he is likely to attain. Something more than technical training must be taken into consideration. Personal characteristics, emotional reactions and attitudes play so large a part in self-realization as to demand analysis and evaluation.

VIEWED broadly, the opportunities for technical men in the chemical engineering industries lie in three fields: Research, production and marketing. Technical training is a fundamental requirement for the first two and is being recognized more and more as desirable in the third. But the personal traits, qualities and characteristics that make for success in each field are essentially different. Barring the occasional exception, the research worker and plant operator would be out of place in each other's work, and both would probably be lacking in that sense of economics and flair for salesmanship so essential to marketing.

JUDGING from observations and events of the past few months *Chem. & Met.* believes that it will pay chemical engineers to take an inventory of their personal equipment for salesmanship and promotion. For such as find themselves adapted to the work there is a growing opportunity for employment. Managers of chemical engineering industries are finding it advantageous to promote the use and sale of their products through engineers who act as salesmen, market analysts, economic advisers, co-ordinators of laboratory and plant, and interpreters of research and production to executive and sales departments.

THIS trend is but one evidence of the importance of marketing in our business and economic structure. Repeated emphasis has been laid on the fact that research and production have been better organized and manned than have distribution and selling. Hence the opportunity for men who can bring scientific methods to bear on the problem. But personal aptitude for the work must not be overlooked, and volunteer candidates may well make a searching analysis of their fitness for the work before undertaking it.

Community Idea Among American Chemical Plants

RECENT developments among the plants in the vicinity of Charleston, W. Va., serve to emphasize an important economic trend that has not yet found its full expression in American chemical industry. In Germany real advantage has been taken of the close interrelation of the various branches of chemical manufacture. There the finished product of one plant often becomes the raw material of another and the byproducts of the second plant may in turn prove useful to the original producer. In fact the German I. G. (Interessen Gemeinschaft) gets its name from this "community of interests" although in that instance the relation has been extended to corporate ownership and control.

Near Charleston we find two distinct groups of chemical industries comprising a half dozen entirely independent but nevertheless closely related industries that have been drawn to this area by its natural advantages for chemical manufacture. In one group the central plant is the Belle electrolytic alkali works flanked on one side by the new Lazote ammonia plant of the du Pont company and on the other by the amyl alcohol and acetate plant of the Sharples Solvents Corporation, whose operations are described in an article in this issue of *Chem. & Met.*

The relationship of these plants to one another is an interesting one. The alkali works pumps its chlorine through a short pipe line to the Sharples plant where it is used to chlorinate pentane. The chlorpentanes thus formed are hydrolyzed to amyl alcohols by the use of cell liquor, the dilute caustic soda and salt solution that is also pumped directly from the alkali plant. The byproduct of the hydrolysis is sodium chloride, which, with the exhausted cell liquor, is returned to the electrolytic cells of the alkali manufacturer for re-use in the production of caustic soda and chlorine. The exchange between the two plants is not quite in exact molecular proportions in that some hydrochloric acid is given off as a byproduct in the chlorination. However, this is a very pure product and when concentrated finds a ready market in neighboring chemical plants—although conceivably it, too, might be sent by pipe line to the ammonia manufacturer for use in the production of salammoniac.

The third product of the alkali works is hydrogen gas which the Belle company itself has at times used in the manufacture of synthetic ammonia but which at the present time is piped to the Lazote works where it supplements the much greater hydrogen supply required by the duPont ammonia installation.

The interrelation of the chemical plants of the second group in the South Charleston district is of a somewhat similar character. There the plants of the Barium Reduction Corporation and E. C. Klipstein & Sons Co. adjoin the electrolytic alkali works of Westvaco Chlorine Products, Inc., and are able to draw from it the supplies of chlorine required for the production of barium chloride, carbon tetrachloride and various dye intermediates. On the other side of Westvaco, the Carbide and Carbon Chemicals Corporation is building a greatly extended plant for the production of ethylene glycol. This development, which promises to be the largest single peace-time use for chlorine, has been built around the raw material supply available from the adjoining alkali works.

The economies resulting from such close interrelations are too apparent to require elaboration here. It is significant, however, that these savings in transportation and sales expense reduce to a minimum the costs of distribution, which even in chemical industry take an unproportionate share of the consumer's dollar. We can well afford to encourage the expansion or relocation of many of our chemical industries on such a logical and efficient basis of raw material supply and market demand.

Deserved Recognition of Semi-Plant-Scale Test

ON SEVERAL occasions during recent years *Chem. & Met.* has endeavored to assist industrial research or university men in securing small-scale chemical engineering equipment suitable for duplicating plant operations in the industrial laboratory. At times it has been difficult to persuade the builders of chemical engineering machinery that the meeting of this need is quite as important to themselves as it is to the research laboratory. Hence, it has been a pleasure to note during the last few months several announcements of new semi-plant-scale equipment.

In announcing such equipment one large machinery builder rightly says: "The importance of laboratory work cannot be over-estimated. Research is a necessity to progress and is so recognized as never before." And, fortunately, this and other builders of chemical engineering machinery recognize the importance of having the research work done with equipment that closely simulates in performance the full-scale machinery. No greater stimulus could be given to chemical engineering research whether in the university or in industry.

It is much too long a step from laboratory glassware apparatus to full-scale process equipment. Neither chemical control nor mechanical and thermal relations in the plant can be accurately forecast if one has only the results of tests involving at most a pound or two of material processed in glass or other laboratory ware. It is essential as a preliminary to good plant design that plant conditions be more accurately imitated in the experiments; and about the only way to accomplish this result is by the use of small replicas of the equipment that presumably will later carry out the unit operations in the completed plant.

There are, of course, some hazards in multiplying research results involving a few hundred pounds of material for the purpose of estimating plant results involving hundreds of tons daily. But such extrapolation of industrial research figures to full-scale estimates is much less difficult and involves much less uncertainty if the experimental studies have been made with the right sort of equipment. With this equipment the research director and the business executive find their tasks easier. And the builders of such small-scale machinery are also profited greatly by co-operation in industrial research because they can build the plant more accurately, and hence be more certain of satisfied customers, when they have experimental data obtained with equipment of the right sort. The appreciation of this mutuality of interest is bound to lead to more rapid development of the needed types of research equipment, to the advantage of all concerned.

Business and Industry Convene at Geneva

HISTORY in the making often has little appeal to us because its significance has not yet become apparent. This is particularly true of the numerous international conventions held in Europe since the World War, and of the many American commissions that have gone abroad to participate therein. It may prove true of the International Economic Conference now in session at Geneva to discuss the world's economic and business ills. Such, at least, is the opinion of E. J. Mehren, vice-president and chairman of the editorial board of the McGraw-Hill Publishing Co., who is personally attending the conference. His cabled impressions of the opening of the conference are published in the news pages of this issue.

The American commission, composed of able men experienced in international affairs of this kind, has gone to Geneva with no preconceived plan except to be of help and assistance as opportunity affords. As one issue after another is raised, they will be prepared to give opinion and judgment based on American experience, and leave to European business men the decision to accept or reject their views on ways and means to restore Europe's economic structure. Thus far a spirit of harmony and helpfulness has prevailed and it seems likely that the representatives of business and industry may accomplish things impossible in political conferences.

One result of the opening week at Geneva was the remarkable unanimity of opinion on the necessity of removing international trade barriers in Europe. Repeatedly changing tariffs prevent long-term contracts so essential to stable trade, which will also be benefited by uniform customs, nomenclature and classification. There was less unanimity in regard to the advisability of international cartels, and a strong sentiment was expressed against participation in such agencies by governments. While it is too early to predict with certainty the results of the conference, it is certain that personal contact of international representatives of business and industry will lead to more amicable conduct of international business and a gradual disarmanent in economic matters.

Automotive Industry and Chemical Production

REPORTS for the first three months of 1927 show a definite falling off in automotive production compared with the same period of 1926. Whether or not this lower level is to obtain throughout the year is open to question; but many experts believe that such will be the case and that 1926 marked the peak, at least for the present decade, of the automotive industry.

This great industry, at the forefront of American activities, has been an increasingly large consumer of the products of the chemical engineering industries. Rubber, paints, varnishes and lacquers, glass, artificial leather and other coated fabrics, petroleum products, cleaning compounds and anti-knock fuels are but a few of the many materials the production of which has been profoundly influenced by the rapidly expanding use of the automobile.

If, then, as seems likely, the curve of production in the automotive industry has reached a temporary plane of constant volume, the manufacturers catering to that industry should trim their sails accordingly. This does not necessarily mean that production increases should be curtailed; but it does mean that plans should be laid to distribute such increases in other fields. The need for such plans may never come, but their existence will do much to smooth a course through the near future.

Lime Industry Faces a Crisis

THE Ninth Annual Convention of the National Lime Association must decide fundamental policies of the industry. It will be called upon to decide whether the present disturbed conditions of the business make it necessary to curtail association work practically to the point of eliminating research and development projects. The present assessment of member companies for association work at six cents per ton of lime produced will, if the proposals of prominent members are carried out, be cut to one or two cents per ton. Such a cut, even though it may materially increase the number of member companies and the tonnage represented, will inevitably necessitate the cutting off of the industrial research, structural and highway divisions at association headquarters.

Apparently the major and basic reason for such a change is the inability of the lime industry to find markets for anything like the total tonnage it is prepared to produce. One consequence of the surplus producing capacity in all parts of the country is a severe competitive condition leading to many sales below cost. Such a disorganized and distressed state in the business generally is naturally reflected in the association by a demand for reducing expenses.

Lime is an industrial chemical of much importance, of concern to many chemical engineering industries which use this material in substantial quantities. Such industrial uses represent, it is believed, over 40 per cent of the entire production of the country. Hence anything which affects the welfare of the lime producer at once becomes of concern also to these lime users. Such users may temporarily profit from lower prices for lime because of competitive conditions, but in the long run they cannot be gainers through the distress of this associated industry.

Just at this time it seems peculiarly unfortunate that the research work of the Lime Association should be curtailed. Splendid co-operative arrangements were being developed between the association and several user industries whereby the plant requirements and control of lime-using processes were being studied, to the mutual benefit of producer and user. Cutting off this work now will represent not only a loss of much of the effort already expended, but also a loss of confidence among users in the ability of the lime industry to take part in work of this sort.

Chem. & Met. sincerely hopes that the lime industry will find some way in which to forestall the most serious of these complications. It, with the many lime-using industries, is still hopeful that the leaders of the lime business will find some safe way out of their difficulties short of a complete elimination of these vital industrial studies.

Producing Pure Amyl Alcohols from Gasoline

Combination of chemical processes with accurate fractionation makes possible the large scale commercial development of new organic solvents

By S. D. Kirkpatrick
Associate Editor, *Chem. & Met.*

THE ESTABLISHMENT in this country of an entirely new chemical industry calls for a serious study of economic as well as technical considerations. Obviously the location of any plant in relation to its supply of raw materials, power and labor and the market for its finished product is of primary importance, but with the pioneering development of a new process these factors are likely to determine the ultimate success or failure of the venture. It is of some interest, therefore, to review briefly the program of investigation that led the Sharples organization of Philadelphia to select the Charlestown, W. Va., area for the first commercial development of its process for the manufacture of organic solvents from natural gas gasoline.

For a number of years the company had been interested in the operation of a plant in the Texas oilfields for the recovery of gasoline from natural gas and while there developed the practical distillation of casing-head gasoline to give a very pure pentane fraction which on chlorination and subsequent hydrolysis yielded amyl alcohol. A source of casing-head gasoline was, therefore, one of the first considerations. Charleston is the center of one of the important natural gas fields and furthermore it is near enough to the Mid-Continent and to the eastern distribution centers to be able to draw on all of the principal supplies. A source of chlorine raised a more important issue but Charleston is second only to Niagara Falls in its production of this commodity. In the location finally selected the Sharples plant receives its chlorine through a pipe line direct from the adjoining plant of the Belle Alkali Co. Likewise it gets its caustic soda from the same plant, this being pumped to it in solution.

Fuel costs in this territory are remarkably low. Natural gas with 936 to 1,000 B.t.u. sells in the city of Charleston for 17 cents per thousand cu.ft. and is doubtless available at much less cost to the industries that have developed their own supplies. West Virginia steam coal is available at the mines for $1.60 per ton (with the nut and slack grades at $1.20) and the freight rate within a 70-mile zone is but 88 cents per ton. Naturally steam-generated current is unusually cheap—from 6 to 12 mills per kw.-hr. being common rates to large users. The Kanawha River supplies an abundance of water for cooling.

The Charleston area is said to be within 200 miles of a population of more than 10,000,000 and with both water and rail transportation to the principal industrial markets of the country, no objection is raised from the standpoint of distribution. Therefore, following a preliminary survey made in the summer of 1925 by Eugene E. Ayres of the Sharples organization and later an independent but confirmatory investigation by E. B. Badger & Sons of Boston—the engineering firm charged with the construction of the plant—it was finally decided to locate in the Charleston district. The selection of the actual plant site immediately adjoining a direct supply of chlorine and caustic soda was a matter of subsequent negotiation once the major economic prob-

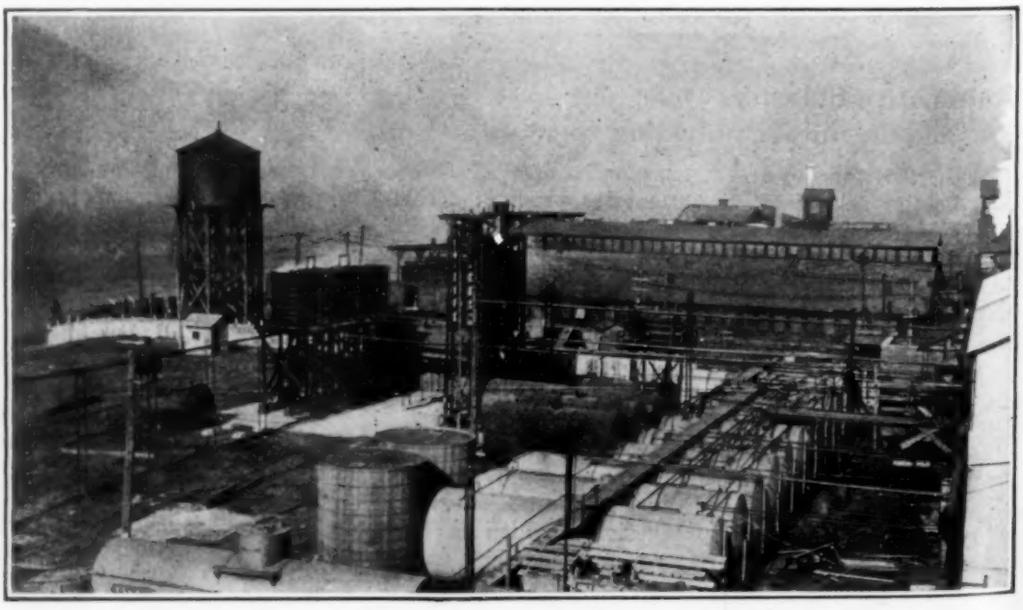


Fig. 1—Product Storage and Hydrochloric Acid Area

Hydrochloric acid, one of the products, is concentrated in the fused silica equipment at the left and stored in rubber-lined wooden tanks. The two wooden tanks in the foreground are for acetic acid storage. The water tower and building in the background are on the adjoining property of the Belle Alkali Co.

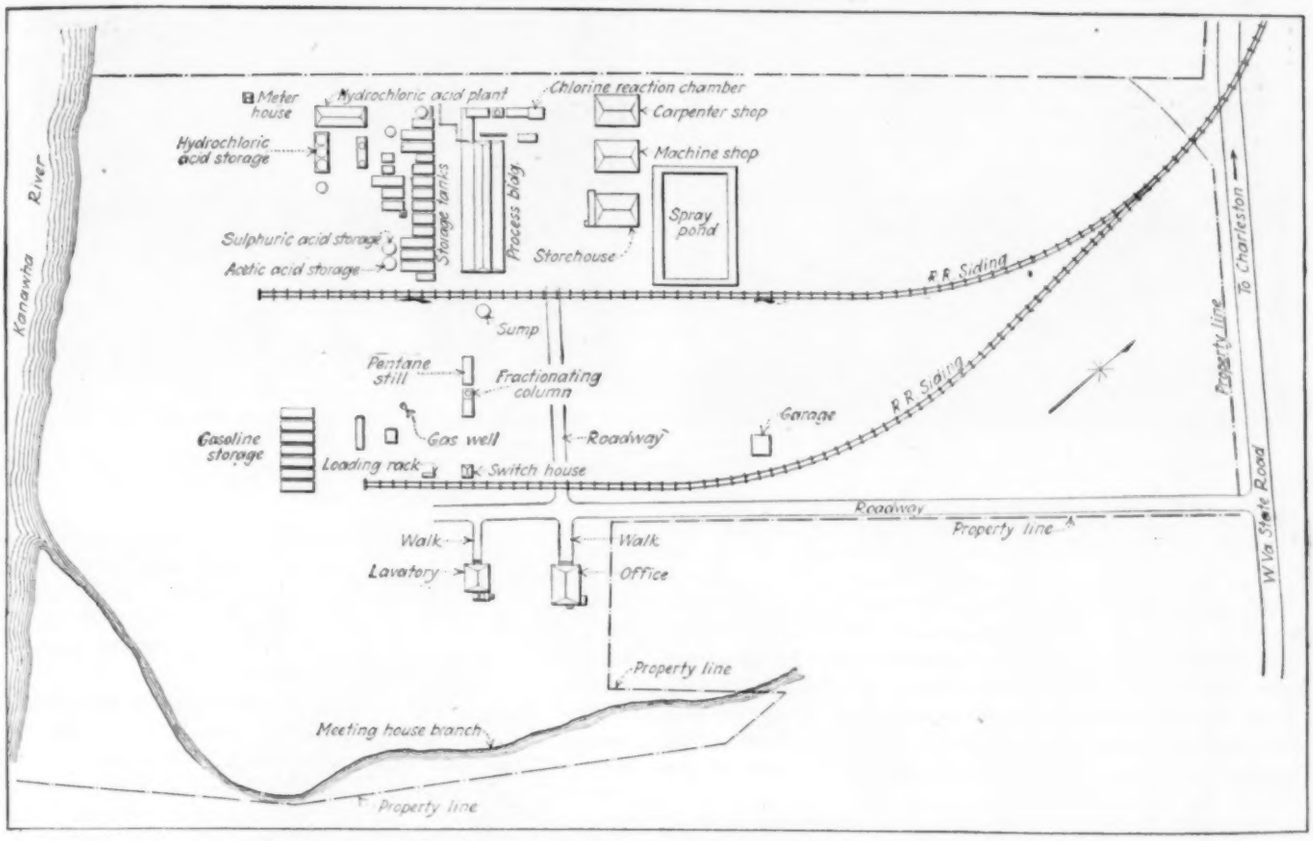


Fig. 2—Plan of the Plant of the Sharples Solvents Corporation at Belle, W. Va.

lems of plant location had been satisfactorily solved.

The manufacturing process by which the Sharples Solvents Corporation produces pentasol, which is practically chemically pure amyl alcohol, and pentacetate, the acetic acid derivative, is a unique application of chemical processes that is made possible by the efficient development of fractionation and other chemical engineering operations. The chief raw material of the plant is the casinghead gasoline, practically any grade of which is suitable for this use since the petroleum refiners' specifications on sulphur and color are of no importance. The grade "BB" containing 20 to 40 per cent of pentane is generally used. The tank cars in which this is received are emptied by gravity into storage tanks of sufficient size to hold several days' supply.

The gasoline is pumped to the kettle still shown in Figs. 4 and 5. Here it is heated by means of steam coils and the vapors passed into a Badger fractionating column which is efficiently designed to give three fractions, of which the middle one, boiling over a range of 28 to 37 deg. C., is a practically pure mixture of the normal and iso-pentanes. The other two cuts are returned to storage and are later blended in proper proportions to give gasoline meeting market specifications.

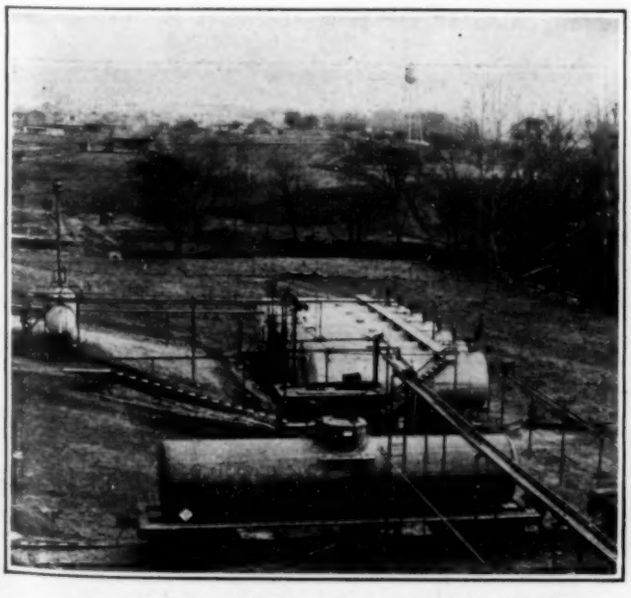


Fig. 3—Gasoline Unloading Rack and Storage Tanks

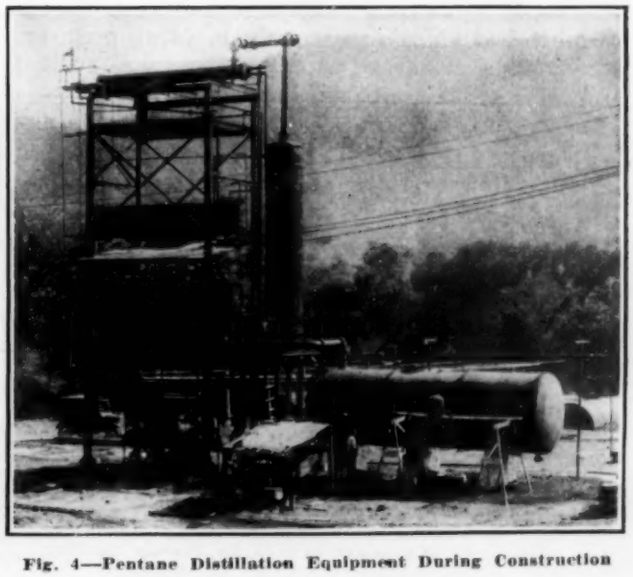


Fig. 4—Pentane Distillation Equipment During Construction

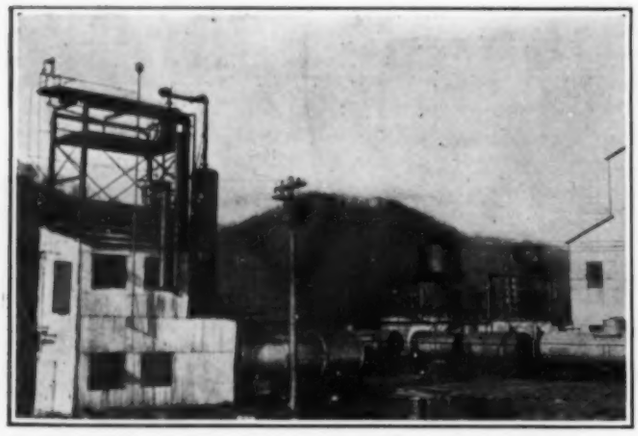


Fig. 5—Pentane Still, Bubble Cap Fractionating Column and Condenser

Here the casinghead gasoline is distilled and closely fractionated to give a mixture of the pure pentanes, the principal raw material for the manufacturing process. The process building and hydrochloric acid plant are at the right

An interesting operating "kink" that may be observed at this stage of the operations is the rather general use of improvised periscopes as means of reading gages and meters at inaccessible places on the equipment. Thus the still operator from his position on the receiving floor beneath the condensers is able to observe and control the rates of flow indicated in weir boxes at the top of the structure.

The liquid pentane under its own vapor pressure is pumped to the process building and at the same time the quantity is measured by means of a meter. The pentane is then vaporized in a tank heated by a steam coil and chlorine gas is added to it in a measured amount by means of a standard Wallace & Tiernan chlorine vaporizer. The chlorine is pumped as liquid from the adjoining works of the Belle Alkali Co. Approximately 1,200 lb. of chlorine is required per hour and an emergency supply of four 1-ton containers is maintained for use in case the usual supply is interrupted.

Although no reaction takes place between the chlorine and the pentane at 100 deg. C.—the temperature to which the mixture is now preheated—the plant is provided with a comprehensive warning and indicating system to control both temperature and pressure. Red and blue signal lights indicate conditions of operation and a warning bell rings continuously in case pressures or temperatures go above or below those desired in the



Fig. 7—Pumping Equipment in the Process Building

These pumps handle the liquid pentane

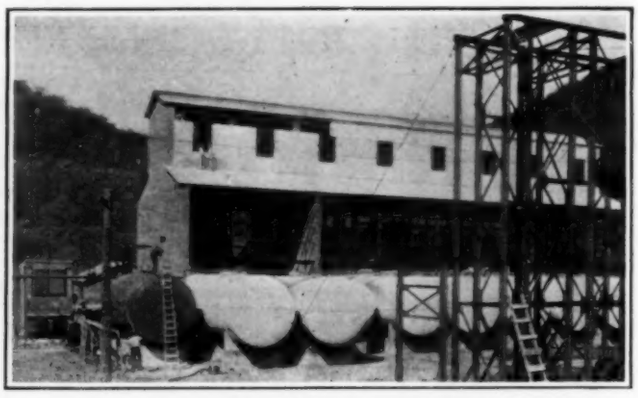


Fig. 6—Process Building, Boiler and Acid Plants During Construction

Caustic soda from the adjacent alkali works is delivered by the pipeline at the left. Liquid chlorine, the other important chemical raw material, is also delivered by pipeline, not shown here

process. The preheated mixture of chlorine and pentane passes under pressure into the tubular reaction unit where the chlorination takes place. This reaction with chlorine to form amyl chloride and HCl is highly exothermic and it is necessary to remove the heat of reaction by cooling with water.

The hydrogen chloride is, of course, uncondensed and passes through the condensing system and into the hydrochloric acid absorption plant. The mixture of amyl chloride and pentane is distilled and the pentane fraction from the Badger fractionating column is returned to the reaction system. In the acid plant, which uses the fused silica equipment and process developed by the Thermal Syndicate, Ltd., the HCl gases from the condenser are run countercurrent to distilled water and are absorbed to a concentration corresponding to 21 deg. Bé. The hydrochloric acid plant consists of two parallel units which have a maximum capacity of 25 tons of acid per day. The acid produced is an unusually pure, water white product that is readily marketed in Charleston and the surrounding district.

Before the amyl chloride is hydrolyzed to pentasol, it is purified by a second distillation. Weighed quantities are then mixed with the required amount of caustic soda which, as previously noted, is purchased from the Belle works in the form of cell liquor containing 8 to 10 per cent of NaOH as well as some



Fig. 8—Night View of the Sharples Plant

By the effective use of a flood lighting system the plant is well illuminated at night, aiding operation and keeping away prowlers, thus reducing fire hazards

undecomposed salt. The hydrolysis is effected in vertical steel columns containing a catalyst which converts the amyl chlorides to the corresponding alcohols, splitting off the sodium chloride. The alcohols thus produced are redistilled and carefully fractionated to yield the product known as pentasol. This is chemically pure amyl alcohol but naturally consists of a mixture of the various isomers of that compound. Thus its actual composition is about 50 per cent of the two primary isoamyl alcohols: $\begin{matrix}CH_2OH\\CH_3\end{matrix}>CHCH_2CH_3$ which boils at approximately 129 deg. C. and $(CH_3)_2CHCH_2CH_2OH$ which boils at about 131 deg. C. Another 25 per cent consists of primary normal amyl alcohol: $CH_3(CH_2)_3CH_2OH$ (boiling point 136 deg.) and the remaining 25 per cent is made up of diethyl carbinol, $CH_3CH_2CHOHCH_2CH_3$ (approximate boiling point 116 deg.) and methyl propyl carbinol, $CH_3CHOHCH_2CH_2CH_3$ (approximate boiling point 119 deg. C.).

The Sharples company also markets a considerable proportion of its output as the acetate derivative, which is known by the trade name of pentacetate. This product is made from pentasol by acetylation with acetic acid, using sulphuric acid as the catalyst. The reaction takes place in a copper kettle still equipped with a copper fractionating column. An excess of alcohol is used in the reaction and the column has been carefully designed to give a neutral product. It is significant that all of the steps in the manufacturing process are covered by existing patents or by applications now pending.

Large-scale uses for both the alcohol and the acetate have been found as solvents in pyroxylin lacquers. Here they exhibit certain properties of peculiar interest to the lacquer industry in addition to desirable boiling point characteristics and high purity. Neither the alcohol or the acetate contains any chlorine nor do they contain aldehydes.

The high purity and uniform character of the products are due primarily to the close fractionation of the pentane fraction and the subsequent purification of its derivatives by redistillation at various stages in the manufacturing process.

Lime Symposium Features A. C. S. Meeting

Editorial Staff Report

A FEATURE of the Richmond meeting of the American Chemical Society was the symposium on lime which was held on April 13 and 14 under the chairmanship of James R. Withrow, professor of chemical engineering in the Ohio State University. The purpose of the symposium was to impress upon manufacturers of lime that the industry was essentially a chemical industry: "The problem of the lime industry is to meet the market demand for the product, and at a profit. The problem is not to produce 'any' lime but to produce the quality of lime that the chemical industry needs," said the chairman in his paper on "The Problem of the Lime Industry."

In a paper entitled "The Consumer, the Market, the Lime Business and the Chemical Industry," Charles Warner said that for the production of uniform, high-grade lime products suitable for the chemical industry, co-operation between technical men of the producer and consumer as well as laboratory supervision in the control of lime production, is important. Mr. Warner's contentions were virtually reiterated in the paper by W. E. Carson on "Bridging the Gap Between Research and Profits in the Lime Industry."

"Present Progress and Future Tendencies in the Lime Industry" was the subject of a paper by Oliver Bowles, who said that tendencies were toward mass production and the increased use of mechanical devices, although manual handling persists in many plants. Mechanical loading combined with limestone mining has increased the proportion of fines, but this source of loss is partially overcome by the advance of the rotary kiln.

J. V. N. Dorr and A. W. Bull presented a paper on "Limes used in Causticizing and some Variables Affecting Their Behavior." Temperature, concentration, and rate of reaction greatly influence the physical properties, particle size and rate of settling of both the slaked lime and the resulting calcium carbonate. J. S. Rodgers and J. M. Porter discussed "The Composition of Commercial Limes and Their Specifications in Chemical Industries." Thirty-six representative high-calcium limes were analyzed; the average CaO for quicklime was about 95 per cent and for hydrates 73 per cent.

"The Use of Lime in Water Softening and Purification" was discussed by C. P. Hoover. Hardness can be reduced to a minimum by carbonation followed by treatment with lime. Carbon dioxide converts slightly soluble carbonates into highly soluble bicarbonates, thus preventing incrustation in water pipes. Lime improves coagulation, kills bacteria and removes organic matter, objectionable gases and iron, said Mr. Hoover. "The Use of Lime in the Paper Industry" was presented by P. A. Paulson, who concluded that lime is less destructive to the fibers than caustic soda. During 1926, the paper industry consumed 300,000 tons of lime.

"Lime in the Beet Sugar Industry" was presented by R. W. Shafor, who said that experiments indicate that the rate of calcination is controlled primarily by the rate of heat conduction through the layer of CaO on the face of the decomposing lump. The time required to burn a stone is directly proportional to the temperature differential through the CaO layer and therefore to the square of the edge of the lump. Small stone therefore requires less coal for burning.

C. D. McLaughlin discussed "The Role of Lime in Tanning." He stated that lime is preferred because of its mild action; its constant hydrogen-ion value when in solution; and because it forms curdy soaps permitting the lime to penetrate the protein, while sodium soaps do not do this. The lime for tanning should be slow settling. In a paper entitled "Lime in the Treatment of Pea Cannery Wastes," L. F. Warrick said that the oxygen demand of such wastes can be reduced about 75 per cent by screening and tank treatment with the application of 7.25 lb. of lime and 3.25 lb. of ferrous sulphate per 1,000 gal. of wastes. The estimated fertilizer value of the dried sludge is $3.50 per ton.

"An X-Ray Study of Limes Having Different Plasticities" was reported by Marie Farnsworth. The patterns of the less plastic samples indicate the presence of calcium hydroxide and calcium carbonate in quick limes and of calcium carbonate in the hydrate. The presence of calcium hydroxide in lime before subsequent hydration reduces plasticity. Calcium carbonate forms a coating on the CaO particles and decreases the rate of hydration and decreases plasticity. Samples burned under vacuum at 2,200 deg. F. were the most plastic.

Metallurgy Features Philadelphia Meeting of A.E.S.

Conductivity of copper electrolytes, electrolysis of fused magnesium salts and preparation of pure nickel, molybdenum, tungsten and zinc described

Editorial Staff Report

MORE than fifty papers were read at the Fifty-first General Meeting of the American Electrochemical Society held in Philadelphia, April 28 to 30. Of these, about ten have been selected as having particular interest to readers of *Chem. & Met.* and are summarized herewith.

Specific resistivity of copper refining electrolytes was the subject of a paper by S. Skowronski and E. A. Reinoso of the research department, Raritan Copper Works. These investigators found that sulphuric acid concentration is the main factor in obtaining an electrolyte of low ohmic resistance. Copper, nickel and iron as sulphate have a marked effect on increasing the resistivity, and the effect of arsenic is slight. One gram per liter of each of these elements will increase the resistivity of 150 gm. per liter sulphuric at 55 deg. C. by the following percentages:

Copper	0.657
Nickel	0.766
Iron	0.818
Arsenic	0.0725

If copper is considered as 100, the relative effect of the impurities on the percentage resistivity of the electrolyte as compared with copper is as follows:

Copper	100
Nickel	116
Iron	125
Arsenic	11

It will be noted that the effect of nickel and iron on the resistivity of the electrolyte is greater than that of copper, and the effect of arsenic is much less. From the results of the investigation the following conclusions were drawn: (1) The percentage coefficient of the resistivity per gram per liter of sulphuric acid and within a wide temperature range is independent of the temperature; (2) Within the cell temperature limits of electrolytic copper refining (50 deg. to 60 deg. C.) the percentage resistivity compared with 55 deg. C. as 100 per cent is independent of the sulphuric acid concentration; (3) Within the cell temperature limits of electrolytic copper refining, the percentage resistivity of varying acid concentrations, compared with 150 gm. per liter of sulphuric acid as 100 per cent is independent of the temperature; (4) With constant composition of sulphuric acid, the percentage resistivity taking that at 55 deg. C. as 100 per cent, is independent of the concentration of copper and nickel at varying temperatures; (5) With varying concentrations of sulphuric acid and copper sulphate at a constant temperature of 55 deg. C. the percentage resistivity, taking 150 gm. per liter of sulphuric acid as 100 per cent, is dependent on the acid concentration and is independent of the copper concentration. This is true also for nickel sulphate, arsenic acid, ferrous sulphate and ferric sulphate; (6) The effect of the addition of copper, nickel, arsenic and iron upon the resistivity of sulphuric acid solution, 150 gm. per liter, is directly proportional to the amounts added; (7) Glue has no effect on the resistivity of sulphuric acid solution.

In order to obtain lower resistivities, the refineries have increased the acid concentration of the electrolyte until some of them are operating with a total acid content of 220 gm. per liter. The concentration of acid which may be used is limited by the crystallization of copper sulphate at the anode, the occurrence of which is in turn dependent upon the purity of the anode, the composition, circulation and temperature of the electrolyte and the current density. Consequently no recommendation can be made in general as to the acid concentration corresponding to the lowest power cost per unit of copper refined. This problem must be answered by the individual refineries and based upon local conditions.

D. B. Keyes, professor of applied chemistry, University of Illinois reported his studies on the electrolysis of a wide variety of fused magnesium salts. The salts included the chlorides, fluorides, phosphates, sulphates, carbonates, sulphites, nitrates, and silicates of the alkali metals, alkaline earth metals, aluminum and zinc. The preferred bath and preferred electrolyte was magnesium fluoride, with small quantities of barium, calcium and sodium fluorides. In the angle type of cell the preferred voltage was from 40 to 100 volts, and in order to obtain any capacity the amperage should range from 300 to 500 amperes. The preferred current density at the cathode was 10 amp. per sq.cm. when a 10 per cent excess of magnesium oxide was used. There was no indication that the magnesium or calcium fluoride present decomposed under these conditions when there was an excess of magnesium oxide. The product seems to be fairly good grade and free from undesirable impurities. In all probability if the process were utilized on a large scale the product would have a much higher purity due to a better control of operating conditions. Unfortunately, the investigation had to be abandoned in 1918.

H. M. Cyr described the preparation and properties of pure zinc, a product which contains less than 0.0001 per cent of metallic impurities. A comparison of the commercial grades of zinc was made with the new product, "spectroscopically pure" zinc. "Spectroscopically pure" zinc is prepared by a series of fractional distillations of "chemically pure" zinc under vacuum until the product shows no impurity lines when examined spectrographically. This pure zinc exhibits unusual resistance to tarnishing and to the action of hydrochloric and sulphuric acids, but not to nitric acid. In dilute

hydrochloric acid it lost 0.02 per cent by weight in the same time that a similar piece of commercial high-grade zinc entirely dissolved. Its slow rate of solution in these acids can be hastened by the use of a platinum couple. The physical properties of "spectroscopically pure" zinc are marked by unusual softness, a low recrystallization temperature, which prevents strain hardening in cold rolling, a melting point of 419.45 deg. C. and a tensile strength of 14,000 lb. per sq.in. (1,000 kg. per sq.cm.). This metal is being produced in small quantities in the laboratory and is being used in scientific investigations requiring metal of the highest purity.

R. J. McKAY of the International Nickel Co. discussed the applications of pure nickel. Nickel free from sulphur, the most undesirable impurity, can be made by electrolysis from chloride solutions. Copper can be removed by cementation with iron; iron can be precipitated as the oxidized hydrate; carbon by filtration or settling; and cobalt by the well-known nitrite separation or by treating the solution with nickel dioxide. Sulphur-free nickel is now on a large-scale production basis, and additions to the metal can be made which counteract the effects of traces of residual sulphur, or sulphur that might be introduced by contamination in the operations of melting, annealing or forging in the shops of the consumer.

The preliminary studies made on the properties of chemically pure nickel do not indicate any immediate possibility of improvement over the ordinary commercial grades. The properties of commercially pure nickel are therefore of more practical importance. This material fills a distinct field of its own, and as its supply and availability in malleable form become more complete, it is even replacing some of its own alloys.

In nickel plating and electrodeposition, the factor of purity has been much discussed. Certain impurities in the anode will make nickel dissolve more easily in the plating bath and therefore these impurities may be considered valuable. At the cathode, extreme purity can probably do no harm. However, it is possible to introduce impurities from the anode which will show no ill effect there, but will be detrimental when they reach the cathode. The foreign elements which should be present, or can be allowed, in nickel anodes and cathodes therefore depend on local practice and on the facilities for chemical and mechanical handling of them. Obviously, where electrodeposition is used for purifying nickel, the greatest practical purity of all parts of the refining cell is desirable.

REASONABLE control in electrolytic refining enables the production of a product purer than is necessary for most uses. The possibly directly damaging impurities, such as sulphur, and in some cases carbon, are practically absent in a good electrolytic product. The foreign material present in greatest extent is cobalt, which may run 0.5 per cent. Cobalt is in all ways analogous to nickel, its physical properties and chemical reactions being practically identical. Its commercial alloys have physical properties and corrosion resistance superior in some respects to those of nickel and nickel alloys. But to expect improvement in the strength and corrosion resistance of nickel or its alloys, due to its small content of this higher-priced material, cobalt, would be as amusingly optimistic as to hope for superiority due to the nickel being " free from cobalt."

It is only during the last year or so that wide ranges of such shapes have been quickly obtainable in quantity. Design engineers in several of our progressive industries are seizing the opportunity to put this new product to work. The new use of most general interest is probably in the food handling processes, and an illustration is apparatus for handling pure milk in modern dairies. Such apparatus has in the past been made of glass-lined or tinned copper tanks. In a few special cases pure copper or high-copper alloys have served. It happens that pure nickel is free from just the defects which have caused difficulty with the older types of milk apparatus. It will not affect the flavor or wholesomeness of the milk by corrosion by milk acids. It is structurally rugged and durable. Inferior material such as tin-coated copper must not be exposed by the removal of coatings by wear or fracture. Nickel is resistant to alkaline conditions which may obtain in cleaning diary apparatus and the use of cleaning abrasives can do it no harm.

The first uses to which the new malleable nickel is being put are for pasteurizing and cooler parts which come in contact with milk and milk products, and for sanitary tubing for conveying them. Apparatus such as direct expansion coolers, which formerly had to be fabricated of two different materials, one suitable for the milk contact and the other resistant to ammonia, is particularly well suited to be made of nickel, since nickel is not affected by either milk or ammonia. Furthermore, nickel is structurally stronger than either of the materials formerly used.

THE protective value of nickel plating was discussed further by C. T. Thomas and W. Blum in a paper that is a continuation of work reported in 1925. Steel nickel plated with a deposit 0.001 in. thick was exposed to the atmosphere of Washington, D. C. for fifteen months. It was found that accelerated corrosion tests on nickel-plated steel are not an accurate criterion of behavior on protracted exposure to the atmosphere. Porosity measurements, such as the ferricyanide test, expressed in terms of the reciprocal of the number of perforations in a given area, usually give an approximate indication of the behavior on atmospheric exposure. Nickel deposits with a high iron content turn yellow and permit excessive corrosion of the underlying steel. Deposits containing a substantial copper layer, either prior to the nickel coating, or between two layers of nickel, furnish far better protection in the atmosphere than deposits of pure nickel of equal thickness.

A. Kenneth Graham, chemist of the Hanson & Van Winkle Co. outlined the chemistry and control of the bright dipping of metal. Mr. Graham discussed the application of acid dips to copper and brass and the acid mixtures frequently recommended. A study of the chemistry of dips containing sulphuric, hydrochloric and nitric acids was made. It was found that the rate of solution of copper varies directly with the nitric acid concentration, and that the rate of solution of zinc varies directly with the concentration of hydrochloric acid. The activity of a dip depends upon the proportion of sulphuric acid to water and upon the temperature. The temperature also has a marked effect upon the rate of solution, increasing the rate for copper up to 50 deg. C., while the rate of solution of zinc is decreased. Above this temperature all dips decompose rapidly. Results obtained on copper and zinc separately have been found to apply to both high and low brass. Operating details for bulk dipping of metal were specified.

The following formulas for bulk dipping were found to be satisfactory:

	Bé.	Sp. Gr.	Scaling Dip		Bright Dip	
			Gm. per Liter	Cc.	Gm. per Liter	Cc.
H_2SO_4.....	66	1.84	700	380	800	435
HNO_3.....	40	1.38	100	72	100	72
HCl.....	21	1.17	5	4	2.5	2
H_2O.....	..	....	444	444	491	491

THE equilibrium for the reaction involving carbon monoxide, carbon dioxide and carbon was reported by Alfred Stansfield, professor of metallurgy in McGill University. Professor Stansfield was led to investigate this reaction by work he had done on the reduction of iron ores by carbon or carbon gases. Prior results have been published by Boudouard and by Rhead and Wheeler, and the work of these investigators was compared by Professor Stansfield. Equilibrium for the reaction $2CO = CO_2 + C$ has been determined by Boudouard, and more recently by Rhead and Wheeler. The latter obtained satisfactory results at 850 deg. C. and higher temperatures, but were unable to reach equilibrium at 800 deg. or 750 deg. C. The results of these admittedly incomplete reactions have, however, been accepted by others as being more accurate than Boudouard's figures, and have been published in the form of a curve extending to 700 deg. Professor Stansfield used LeChatelier's equation, and an equation derived by Lewis and Randall, to test this curve and that of Boudouard from 800 deg. to 450 deg. C. Boudouard's curve was found to be approximately correct, while the curve based on Rhead and Wheeler's low temperature measurements was found to be decidedly incorrect.

P. H. Emmett, assistant chemist in the Fixed Nitrogen Research Laboratory presented a resumé of the factors influencing the rate of the gaseous reduction of metallic oxides. He found that the reducibility of an oxide by a reducing gas depends upon (1) The chemical nature of the oxide being reduced; (2) Whether the reduction is antocatalytic; (3) The temperature and method of preparation of the oxide; (4) Whether the oxide being reduced is in mass or supported in thin layers on a suitable supporting substance; and (5) Whether there are present materials intended to promote or increase the activity of the metallic catalyst resulting from the reduction. It is well to take cognizance of all these factors in the discussion of particular cases and problems involved in gaseous reduction of metallic oxides.

Edwin K. Jenckes of the York Metal and Alloys Co. described the preparation of oxides and salts of tungsten and molybdenum having the chemical purity and physical characteristics required for the manufacture of the pure metals used in electric lamps and other electrical equipment, as for example, radiotrons, rectifying tubes, and electrical contact points.

A related paper, on the gaseous reduction of tungsten and molybdenum oxides was presented by E. W. Engle, chief engineer of the Fansteel Products Co., Inc. In order to obtain the required high standard metals, hydrogen reduction of WO_3 and MoO_3 was resorted to, in contradistinction to carbon reduction universally used in the production of ferro-tungsten and ferro-molybdenum for alloy steel manufacture. The oxide of tungsten or of molybdenum is placed into a heated tube, and a fairly rapid stream of hydrogen gas passed through. One kilogram of tungsten powder requires from 900 to 2,800 liters of hydrogen. The reduction of WO_3 begins at about 620 deg. C., and that of MoO_3 at about 300 deg. C. The desired physical structure of the metal powders is obtained mainly by a proper balance of rate of hydrogen flow and temperature rise.

The solubility and electromotive force methods for determining the activity coefficients of an electrolyte in a solution of another electrolyte were outlined by Herbert S. Harned. The law of the linear variation of the logarithm of the activity coefficient was discussed from a number of points of view. The activity coefficients of strong acids and bases in salt solutions were contrasted, and a method was outlined for the determination of the ionic activity coefficient product and dissociation of water in salt solutions. Liquid junction potentials and individual ion activity coefficients were defined and discussed. The thermodynamic behaviors of the hydrogen and hydroxyl ions were contrasted with their catalytic effects.

Edwin W. Rouse and Paul K. Aubel presented analyses of copper refining cell voltages. It was found that there is a decided drop in the total cell voltage with rise in temperature of solution and with increase in acid concentration. On the other hand, an increase in $CuSO_4$ or in $NiSO_4$ or in As_2O_3 concentration has but a slight effect on the total cell voltage within the operating range. The addition of 10 mg. per liter of glue to the electrolyte increased the total cell voltage by about 60 per cent.

Effects of Research in the Lime Industry

Fundamental factors in burning and in hydration studied; better results for the consumer now assured

By F. W. Adams

Director, Bangor Station, School of Chemical Engineering Practice, Massachusetts Institute of Technology

THE development of transportation facilities of the past few decades has made possible the economic production and distribution of lime on a large scale. This is causing the elimination of the old kiln operated in farming communities for purely local use. Thus the number of plants in operation today is less than half what it was ten years ago, although total production is greater. With the larger scale of production has come the scientific control of kiln operation, increasing the efficiency of combustion and calcination and improving the quality of the product.

Formerly wood was the major fuel used for lime burning. At the present time coal, coke, producer gas and oil are all being successfully used. The use of wood in lime burning has various advantages, as it is possible to obtain "long-flame" combustion with the resulting uniform temperature and distribution of heat throughout the kiln. With this fuel it is almost impossible, under operating conditions, to overburn the lime. The increased cost of wood has lead to the utilization of cheaper fuels which, however, are ordinarily burned with a short flame with consequent high temperature. Therefore the combustion of the fuel now largely in use has necessitated the development of equipment in which the long flame of wood may be approximated.

In order to control the physical properties of a lime, it

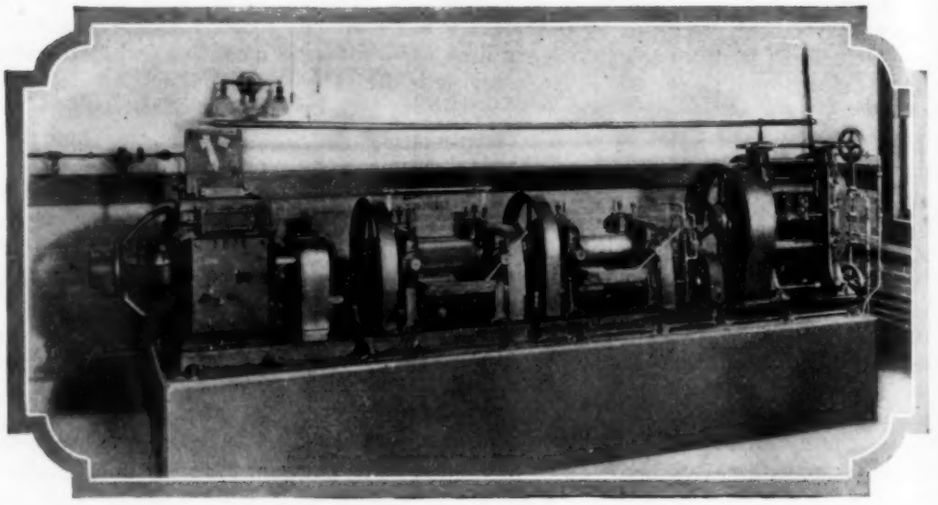
is necessary that these properties be understood. These are probably best discussed by considering some of the specific uses of lime. For example, in lime for building construction, such as for use in a plaster, it is desirable to have a lime which may be spread easily on lath or dry plaster to allow building up of a smooth, white, permanent surface. Obviously the most valuable lime is the one which will cover the most surface, requiring the least physical effort and yielding a wall which will be entirely free from pits. The lime man speaks of putty volume to designate the volume of putty which may be produced from a given weight of lime. He also speaks of a "fat" lime yielding a putty of high plasticity, that is, a lime which will yield a smooth, creamy putty, which can be readily spread and which although drying does not lose its slippery feeling. The presence of small particles of unhydrated lime in a putty results in a hydration of these particles after the surface has hardened, causing the appearance of pits or in an extreme case, of cracking and blistering. It will be readily seen that the determination of these properties is entirely different from the usual chemical analysis. Other users of lime have established similar definite, but more or less arbitrary, properties. Thus we hear the chemical users speak of "available lime." This term designates the reactivity, that is, rate and extent of reaction, in the particular process under consideration. However, the available lime in a given sample is not a distinct property of that sample alone, but depends also on the process in which it is to be used. For example, a lime suitable for sugar refining may have a higher availability in that industry than in the alkali industry. In a few processes in which lime is applied, we are concerned not only with the property of the hydrate, but also with the properties of reaction products formed from the hydrate (the rate of settling of a lime sludge is of great importance in alkali production).

THE definition of these arbitrary properties of lime has been necessitated by the lack of a complete knowledge of the properties and reactions of lime. Although an exceedingly common material, the laboratory study of lime has been largely overlooked. It is true that there are some data available on the dissociation of calcium carbonate and the vapor pressures and solubilities of calcium hydroxide. A study of the reactions of lime shows them to be of unusual complexity and this is undoubtedly due in large measure to the low solubility of lime. It is interesting to note that there is really no satisfactory proof that $Ca(OH)_2$ is the only hydrate which may be formed by the reaction of CaO and H_2O at temperatures above the freezing point of water. Thus it will be seen that it is necessary to have cooperation between the producer and consumer, in order that the physical properties of a lime may be suited to its use.

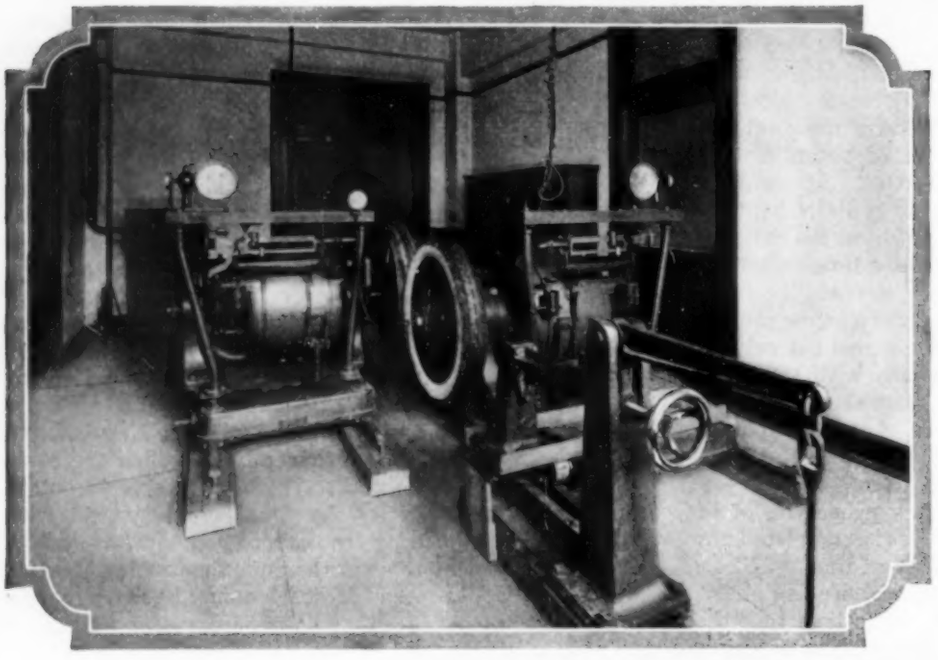
The physical properties of a quicklime are largely determined by the conditions of burning and these properties must be modified to suit the particular needs of the process in which the lime is to be used. When a lime is subjected to a temperature of about 1,400 deg. C., sintering of the lime and the formation of fusible compounds with such impurities as alumina, silica and iron oxide occurs. At the same time, there is a shrinkage in volume of pores giving an increased density of quicklime. The product of "over-burning" is unreactive and for many uses is entirely unsatisfactory as a lime. In the production of "dead-burned" dolomite for use as a basic refractory, a dense unreactive lime is desired; and conditions which favor overburning, such as addition of impurities and calcination at a high temperature, are therefore required. In the other consuming industries where the quicklime does not come in contact with water, chemical composition as regards impurities also is important. Phosphates and sulphates should be absent or low in metallurgical lime, and the glass manufacturer demands a low iron content. In all of these industries a dense lime is to be preferred. This is obtained by employing a relatively high temperature of calcination and makes possible the ready use of any of the common fuels, even including powdered coal.

ON THE other hand, in the aqueous reactions of lime, its physical structure as determined by conditions of burning and hydration is of paramount importance, small amounts of impurities commonly present in general acting merely as diluents. It has been found by Haslam and Hermann [*Ind. Eng. Chem.*, vol. 18, p. 960 (1926)] that both temperature and time of calcination exert a marked effect on the properties of the limes which they studied. They showed that there is an optimum temperature of burning, at which the plasticity, putty volume, and rate of reaction with acid of the quicklime produced is greatest and at which its rate of settling is lowest. At temperatures above and below this point, the reactivity of the lime is greatly reduced. This temperature, although not necessarily the same for all limes, is around 1,100 deg. C. The time during which the lime remains at this temperature is also of great importance, and it is possible to effect a marked decrease in plasticity by increasing or decreasing the time of calcination. The addition of alkali metal salts to a limestone has been shown by Mathers [*Ind. Eng. Chem.*, vol. 19, p. 88 (1927)] to produce limes which are more satisfactory for some uses. Thus, he is able to obtain limes of high plasticity, by treating the stone with sodium chloride prior to calcination. The sodium chloride treatment renders the quicklime softer and less active, so that its rate of hydration may be more readily regulated.

THE desirable physical properties obtained with a properly burned lime are very sensitive to the subsequent hydration reaction through which the lime must pass before it is useful. It is easy during the hydration to attain temperatures as high as 465 deg. C., with a consequent burning of the hydrate, producing a coarse inferior product. Whitman and Davis [*Ind. Eng. Chem.*, vol. 18, p. 118 (1926)] have shown that by hydration of quicklime in a large excess of boiling water the most reactive hydrate may be obtained. This hydrate has a low rate of settling and under the microscope the clusters of crystal particles are small and loose. On the other hand, hydration with the theoretical amount of water necessary to satisfy the chemical equivalent of the lime, or hydration with water vapor, gives a high rate of settling and low rate of reaction with acid. Inasmuch as the hydration of lime should only be carried out under carefully controlled conditions, hydration by the consumer may yield an unsatisfactory and inferior product. Recognizing this fact, the producers of lime have turned their attention to the manufacture of hydrate and are preparing a uniform hydrate under controlled conditions, when the seasonal demands for quicklime are low.

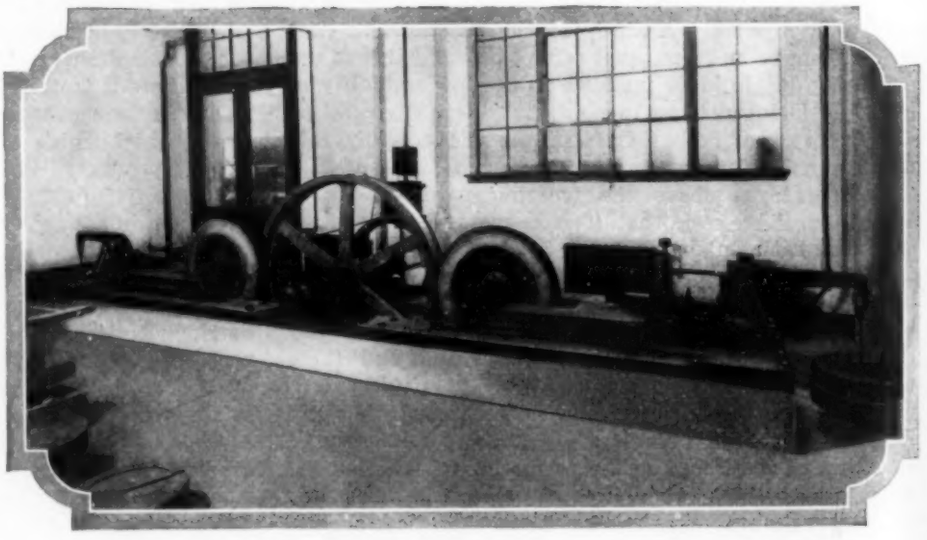


EXPERIMENTAL RUBBER MILL.—*This equipment is a miniature reproduction of similar machinery used in rubber factories. It is designed for laboratory experiments on the properties of rubber compounds. The small corrugated rolls at the left are used for washing wild rubbers. The mixing rolls in the center are for compounding rubber with various materials including fillers, pigments and sulphur prior to vulcanization. The calender rolls at the right are used to produce sheet rubber of uniform thickness.*



Bureau of Standards Tests Endurance of Tires

TIRE TESTING DYNAMOMETER.—*This equipment is designed to measure the power loss, or energy dissipated as heat, in a tire. Tires may be operated at any speed between 10 and 50 m.p.h. and under any desired conditions of axle load and inflation pressure. The unit carrying the tire operates as a motor, and the tire is caused to drive the drum which is carried on the unit operating as a generator. The difference between the energy delivered to the tire and the energy transmitted by the tire to the drum represents the power loss in the tire.*



ENDURANCE MACHINE FOR TESTING TIRES.—*The test drum is 1/300 of a mile in circumference and operates at a surface speed of 30 m.p.h. The drum is provided with cleats as shown, which cause severe flexing of the tire. The standard test for Government acceptance requires that the tire run against the drum for 1,350 miles under standard conditions of axle load and inflation pressure without developing any indication of weakness.*

Collection and Recovery of Dust by Mechanical Means

Discussion of the advantages and disadvantages of various designs of equipment available for carrying out this process

By Graham L. Montgomery
Assistant Editor, *Chem. & Met.*

DUST COLLECTION and recovery problems in the chemical engineering industries arise from several conditions, one or more of which may be present in any industry and make the employment of this process necessary. These conditions may be set down as follows:

1. The dust may be injurious to the workers.
2. The dust may be a valuable product of the process in which it is developed.
3. The dust may be obnoxious if allowed to settle in the neighborhood of the plant.
4. The dust may be an undesirable constituent of a gaseous product.
5. The dust may constitute an explosion or fire hazard.

When full consideration is given to these points, it is apparent that few industrial plants producing any dust in the course of their processes can neglect the collection of this dust. In the chemical engineering industries, where dusts occur, it is nearly always true that they represent a recoverable value. In addition, it is a fact that, in most localities, laws are in existence which make the collection of industrial dusts imperative. However, whatever the impelling motive may be, the elimination of dust from the plant atmosphere is always a profitable undertaking because of improvement in working conditions, lower labor turnover and decreased wear of equipment by dust abrasion.

There are many methods of dust collection which have proved satisfactory in certain industries but which do not permit easy recovery of the collected dust and are hence not of primary importance to the chemical engineering industries where such recovery is desirable. Examples of these methods include scrubbing or washing the dust-laden gases with water or other liquids, collecting by passing the gases through screens or other devices in which they are brought into contact with a viscous substance, and simple ventilation of the dusty space by fans with discharge into the atmosphere.

Another method of dust collection, highly satisfactory from many standpoints, is the Cottrell electrical precipitation method. This is an effective means of removing solid or liquid particles from gases and should be considered in large-sized undertakings where the investment required is not out of proportion to the savings that are to be made.

However, many installations in the chemical engineering industries are not sufficiently large to warrant such an investment. Also, in other cases, investigation will show that less expensive mechanical collecting equipment will do the work as efficiently. In fact, it may be stated that as a general rule in these industries, dust collection and recovery will be accomplished best by one of three mechanical means.

Dust can be separated from air or gases and then recovered by means of settling chambers. These chambers are enlargements of the passage through which the dust-laden gas is conducted, as, for instance, a large chamber built at the base of a stack through which the waste gases must pass before going up the stack. The size of such a chamber must be sufficient so that the gases will pass through it very slowly, allowing time for the dust particles to settle to the bottom by gravity.

According to Gibbs ("Clouds and Smokes" by W. E. Gibbs. P. Blakiston's Son & Co., Philadelphia, 1924): "any particle suspended in a gas is subjected to two sets of forces. It is pulled downwards by gravity with a force, F, and the resulting movement downwards is resisted by the viscous friction of the gas, R. In general, for particles larger than 10^{-2} to 10^{-3} cm., according to the density of the particle, F is greater than R at all velocities, and the particle settles with increasing velocity. For smaller particles the resistance of the gas increases with the velocity of the particle until R equals F. The particle then continues to fall at a constant velocity (v).

"Values for v for spherical particles of unit density, falling in still air are given in the table:

Diameter of Particle	Rate of Settling: Cm. per Sec.	Rate of Settling: Meters per Hour
10^{-2} cm.	30	1,080
10^{-3} cm.	0.3	10.8
10^{-4} cm.	0.003	10.8 cm.
10^{-5} cm.	0.00003	1.08 mm.

"From this it is clear that effective settling from air or gases in motion can only be obtained with particles of more than 10^{-3} cm. diameter. Smaller particles settle so slowly that they are carried up again by the least upward movement of the air. For particles of diameter smaller than 10^{-5} cm., the mean free path of the gas molecules, the impacts of the gas molecules drive the particles hither and thither about the gas in ceaseless Brownian motion. For such particles the force of gravity has but little effect compared with that of the individual molecular impacts."

The degree of dispersion of a number of industrial dusts is shown below:

Substance	Diameter of Particles, cm
Milk powder (spray dried)	1.4×10^{-2} to 0.7×10^{-2}
Cement	1×10^{-2} to 0.7×10^{-2}
Smelter fume	1×10^{-2} to 1×10^{-5}
Cement kiln flue dust	6×10^{-3} to 0.8×10^{-3}
H_2SO_4 mist from concentrators	1.1×10^{-3} to 1.6×10^{-4}
NH_4Cl fume	1×10^{-4} to 1×10^{-5}
Oil smoke	1×10^{-4} to 5×10^{-6}
Rosin smoke	1×10^{-4} to 1×10^{-6}

Table from "Clouds and Smokes," by W. E. Gibbs.

From these facts it is evident that, if a large amount of gas is to be handled or if the dust to be collected contains any considerable amount of particles smaller than 10^{-3} cm. in diameter, a settling chamber would have to be very large to do the work and would therefore involve a high first cost and high carrying charges. Also, in most cases of dust collection in the chemical engineering industries, as near to complete separation of dust from gases as can be obtained economically is to be desired. With dust containing even a small portion of particles below 10^{-3} cm. in diameter it is useless to try to effect complete collection by means of a chamber.

Certain modifications of the settling chamber permit the use of a much smaller space for a given amount of gas, that is, gas can be moved at a higher velocity through them. Or, if these modifications are used with a large chamber, smaller particles can be collected. One type of modified chamber is constructed by inserting horizontal shelves in the chamber, thus decreasing the distance through which the particles must fall in settling. The shelves are so arranged that an equal volume of gas passes over each, insuring maximum capacity.

Another type of modified settling chamber has vertical baffles placed parallel to the flow of gas. As the dust-laden gases pass through, dust adheres to these plates, in addition to the amount that settles as it would in a simple chamber. Thus the capacity for a given size is increased. In this type of chamber it is customary to have some arrangement for periodically removing the dust accumulations from the plates.

In still other cases baffles are inserted opposed to the flow of the gas. While such baffles serve to knock out much of the dust by impact and thus cause it to settle, they also set up a turbulence in the gas flow which effectively prevents the removal of any very fine particles.

From the standpoint of dust recovery, the settling chamber is not to be generally recommended because of the labor and inconvenience that attend the removal of the collected dust. A simple chamber without shelves or one with vertical baffles or plates can be provided with hoppers in the bottom for facilitating dust removal. But even then much dust remains within on walls and projections and this must be removed by hand or the capacity of the chamber is rapidly lowered.

Another drawback of the settling chamber is the impossibility of collecting the smaller sizes of dust particles with it. Where the dust to be collected is obnoxious or where it has considerable value, the settling chamber is not often applicable because it does not remove enough.

An advantage of the settling chamber is its ability to handle gases at high temperatures that certain more efficient types of dust-collecting equipment cannot withstand. Because of this fact, combination collecting systems are sometimes used, in which the coarsest dust settles out in a chamber while the gases are being cooled and the final dust removal is accomplished in some other design of equipment.

A more adaptable and also more compact dust collector makes use of centrifugal force for the separation of dust from gas. There are two general types of centrifugal collectors, one a stationary device in which the gas is given a whirling motion by means of appropriately designed baffles which are inserted in the path of flow, and the other a revolving device in which the gas is whirled about. Various modifications of these principles are met with in commercial apparatus, the most familiar being the so-called "cyclone."

When the dust is relatively coarse and complete removal is not a necessity, the simplicity, low first cost, low operating cost, ease of maintenance and small space requirement of centrifugal separators make them preferred equipment. Also, the facts that this type of equipment can be located wherever space is available, say on the roof of the building, and can be arranged to discharge periodically or continuously through an air-locked valve and a chute to a conveniently placed storage bin, give it added advantage. Furthermore, it can handle highly heated gases successfully.

However, the centrifugal separator will not remove fine material, being even more limited in this respect than the settling chamber is, because the relatively high velocity of the gases passing through it carries fine particles beyond the gas discharge in spite of the action of the centrifugal force tending to throw the dust particles out of the gas stream. A single cyclone will remove about 87 per cent of the solid material in a gas stream, so that it would require three or four such cyclones in series to equal the dust-removing efficiency of a single-pass dust filter.

When a more complete separation of dust from gas is desired than can be obtained with the settling chamber or the centrifugal separator, or where the particle size is too fine to permit of ready removal in these devices, recourse is had to some type of dust filter. The efficiency of a properly designed dust filter is over 99 per cent, which makes it peculiarly adapted to such industries as the chemical engineering group, where recovery of valuable products and protection from poison or fire hazards are so important.

Dust filtering systems vary greatly in general appearance, but, in the main, the principle of operation is the same. The dust-laden air or gas is filtered through a cloth screen, the dust being retained upon the entrance side of the screen while the air or gas passes on. Screens are made of specially woven cot-

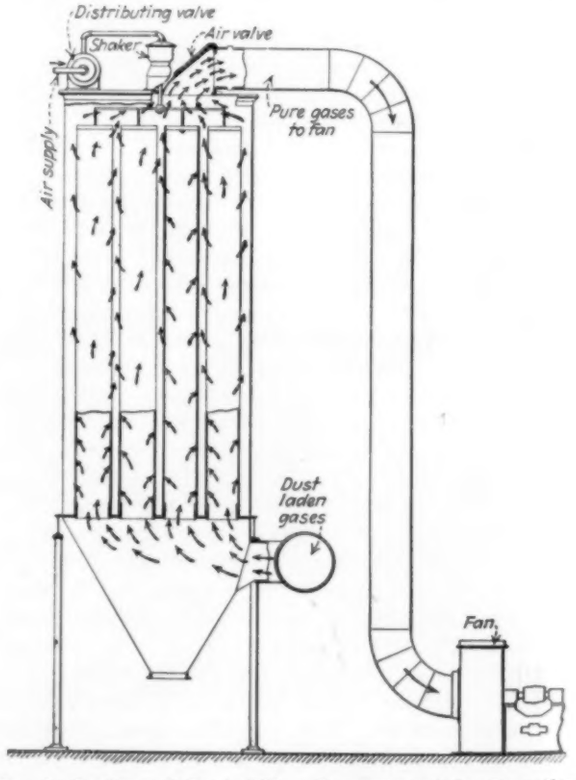


Fig. 1—Section of Dust Filter Compartment in Operation

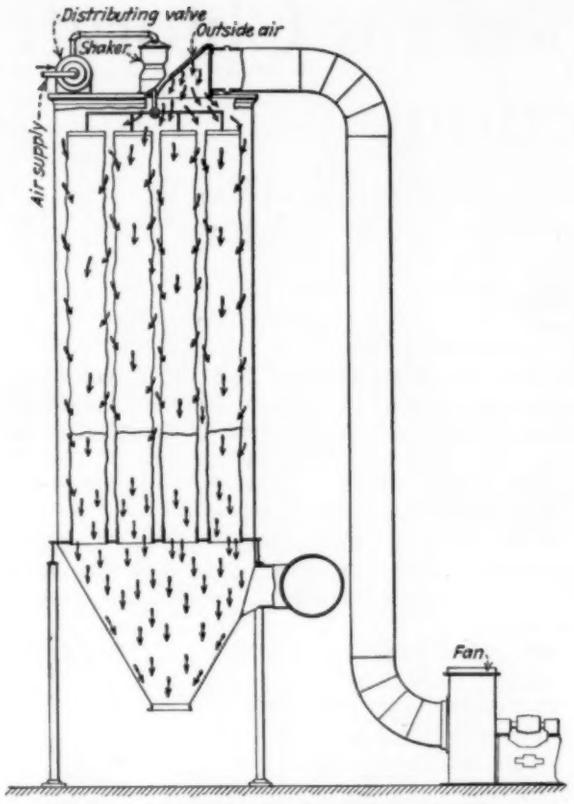


Fig. 2—Section of Dust Filter Compartment Showing Action During Cleaning Period

ton or woolen fabrics, the cotton being cheaper in first cost but the woolen having a longer life, particularly when the temperature is at all high.

Sometimes several passes are necessary before the air is completely cleaned; but it is always possible to so design the filter that the dust is almost entirely recovered. The size of the meshes in the cloth has little to do with the size of the particles that can be collected in this way. Collection is primarily due to the centrifugal action set up in the gases passing through the screen, which causes the dust to be deposited on the fibers of the cloth. In addition, large particles are caught in the meshes of the cloth, which tends to reduce the area of openings and increase the surface.

The description of one type of widely used dust filter will serve to show the method of operation of dust filters in general. In this design the cloth screens are made up in the shape of bags or sleeves, as can be seen in Fig. 1. These bags, usually in groups of twelve, are fastened inside of cylindrical, air-tight, metal tanks with cone-shaped hopper bottoms. The bottoms of the sleeves are open and the tops are closed. These bottoms are attached in a plate, so that dust-laden gas or air, entering below the plate, must pass up within the sleeves and cannot pass into the cylinder except through the sleeves. The air space in the cylinders, outside of the sleeves, is connected through an offtake at the top to an exhauster which maintains a suction on the filter.

The solids in the gas or air are left on the inside of the sleeves. In order that these solids shall not accumulate to the point where the free passage of gas or air through the cloth is blocked, periodical and thorough cleaning of the sleeves is arranged. At predetermined intervals, a current of compressed air, controlled by an automatic distributing valve, shuts the damper in the offtake. This compressed air then operates a small air-motor on the top of the filter, which shakes the frame to which the closed tops of the sleeves are attached. At the same time, the top of the tank is opened to the air, which rushes in and through the sleeves in the reverse direction.

The shaking and the reverse air current loosen the accumulation of solids on the inside surfaces of the screens and cause it to fall into the hopper bottom, as shown in Fig. 2. This cleaning action is completed in a few seconds and the compressed-air motor then automatically shuts down, the tank is closed to the air, and the damper in the offtake is opened.

The hopper bottom is provided with an air-tight valve, which can be operated either by hand or automatically, to dump the collected dust periodically into an appropriate receptacle, placed beneath. As many of these cylindrical units as may be needed can be arranged in parallel or in series.

When the gases passing through a dust filter of the type described above are of high temperature, it is best to provide some means of cooling, for otherwise the life of the cloth screens will be greatly reduced. This cooling can be readily effected by using any one of three methods. The simplest method is to pass the hot gases through a chamber with a relatively large radiating surface. Another means is to provide for the dilution of the gases with cool air. The most expensive method to install, but one by means of which the heat of the gases is recovered, is to pass the gases through a waste-heat boiler. Which of these methods is employed will depend on the individual installation, and such factors as the initial temperature of the gas and the amount of dust that will be deposited in the cooler, must be considered in making a choice. It should be kept in mind that temperatures in the filter should not exceed 250 deg. F. when woolen cloth screens are used, or 210 deg. F. when cotton cloth is used. On the other hand, the temperature of gases in the filter should be kept well above the condensation point when there is any possibility of condensation occurring.

From the foregoing it is clear that the dust filter equipment is the most widely applicable in the chemical engineering field, combining as it does high recovery, convenient handling of dust, automatic operation and low first cost. It seems probable that dust recovery by this method is more economical, in these industries, than by any other method, although it has not been possible to procure figures giving any direct comparisons. Operation of the equipment does not involve much expense. In one plant, collecting about 1 ton per month of tin oxide dust from the fumes given off by two furnaces the only operating cost is that necessary to drive a 54-in. plate type fan at 600 r.p.m. and the supply of a small amount of compressed air to operate the shaker. Attendance is limited to that necessary for dumping hoppers and the replacement of the cloth sleeves, the life of which is about two months. The recovery at this plant is over 99 per cent, only a trace of dust being found in the exhaust from the fan. The installation consists of six of the cylindrical tanks in parallel, each containing six cotton cloth sleeves.

The disadvantage of the dust filter lies chiefly in the fact that, while it does not require much maintenance, it must have attention from time to time if it is to collect the dust with an unvarying efficiency. Leaks from worn-out sleeves must be found and repaired as soon as they occur or a portion of the dust-laden gases will flow directly through the collector.

Economics of Potassium Chlorate Production

Relation of direct and indirect methods for utilizing electrolytic chlorine to the alkali industry

By Gösta Angel
Bohus, Sweden

THE production of hypochlorite and chlorate through the introduction of chlorine gas into alkali or milk of lime is no new process but is a method which was employed before the electrolytic process was developed. Today the direct electrolytic manufacture of alkali hypochlorite has almost entirely ceased. Furthermore, even the direct electrolytic chlorate method is disappearing. Almost all hypochlorite and a great part of all the chlorate which is produced is now obtained in an indirect way from the primary products, alkali and chlorine. This important development through which hypochlorite and chlorate no longer are primary products, but are considered as belonging to the alkali industry, and thus extending the range of this industry and contributing to the solution of the chlorine problem, has scarcely been clearly shown in the literature. A summary ought therefore to be of interest.

During the period from 1890 to 1900 direct electrolytic processes were developed for producing hypochlorite, and many were of the opinion that the older purely chemical methods were of no value. Alkali-chlorine cells had not at this time been fully developed and could not compete in the production of alkali hypochlorite and chlorate. On the other hand, the direct electrolytic process seemed very satisfactory and simple in operation.

It was soon found that the hypochlorite cells were limited to small plants, as laundries, bleacheries, paper and textile plants. In the larger plants it is more advantageous to separate the products, alkali and chlorine, from each other, and transfer the hypochlorite reaction outside the cell. In those cases where it was necessary to utilize the sodium hypochlorite for bleaching, the alkali was allowed to react with the chlorine, either in the form it was obtained from the cells or in a more concentrated solution after the evaporation and the regeneration of the excess salt. As a rule the chlorine was absorbed in lime in solid form to make bleaching powder, or in milk of lime to make bleach liquor. The reason why the apparently more complicated indirect method was more advantageous, is to be found in the higher energy efficiency and the lower consumption of salt and electrode materials. Furthermore, in most cases it was possible to use calcium hypochlorite as well as sodium hypochlorite with the same good result, and therefore sodium hydroxide could be produced as a valuable byproduct on the cost of a more cheap, equivalent quantity of lime.

WITHIN the chlorate industry the development has been similar although more slow. The reason for this is perhaps that the chlorate industry is a relatively small one, is surrounded with secrecy and that the indirect methods are comparatively complicated and seem to offer fewer advantages than the direct ones. As mentioned before, the direct electrolytic methods for the production of chlorate were developed at an earlier stage than the alkali-chlorine processes. The former have had ample time to grow into the relatively few great plants within this industry.

In Scandinavia and Finland the following plants are producing chlorate by direct and electrolytic methods:

A/S Fredriksstads Elektrokemiske Fabriker, Fredriksstad.

Stockholms Superfosfatfabriks A. B., Trollhättan.

Mansbo Kloratfabrik, Avesta.

Elektrolytiska A/B., Trollhättan.

Alby Kloratfabriks A. B., Alby.

Finska Elektrokemiska A. B., Imatra.

The first-named Norwegian plant is not operating. In the Stockholms Superfosfatfabriks A/B. in Trollhättan, chlorate as well as perchlorate and especially ammonium perchlorate is produced. The cells were originally constructed by Oscar Carlson, one of the pioneers of the chlorate industry. During the last years this plant has been either shut down or was only in partial operation, on account of the weak market in the chlorate industry. The other plants are owned by Svenska Tändstiksbolaget (International Match Corporation) the greatest consumers of chlorate in the world. In all the plants belonging to this concern, magnetite electrodes of domestic manufacture are used and potassium chlorate only is being produced.

The match corporation does not employ the indirect method as their demand is solely for chlorate and not for alkali, for the sale of which they would have to establish a separate organization. The situation in Germany has been different. The manufacture of chlorate has not been specialized in certain plants but has taken place simultaneously with other chemical manufacture. On this account the Germans have easier seen new opportunities and have been in a better position to follow the development of alkali technology and have for many years had the experience of the pure chemical process to rely on. The indirect chlorate method is here almost the only one in use.

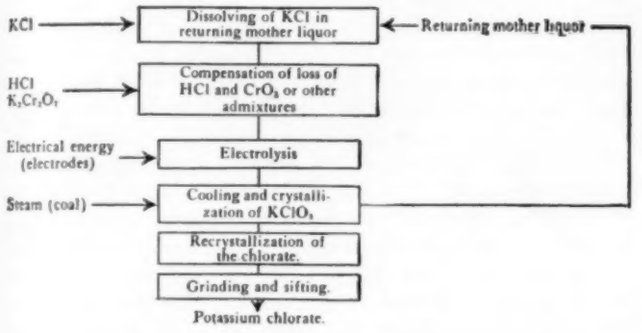
IN ORDER to make a comparison between the above competing processes, flow sheets illustrating both processes and the raw material entering into these are shown herewith.

The indirect method comprises a greater number of different steps and is therefore more complicated than the direct one. Furthermore, some potassium chloride and chlorate is lost in the process, causing the consumption of potassium chloride and electrical energy in the electrolyzing process calculated on the finished product of chlorate to be somewhat higher than in the direct

method. By cooling the solution this loss can be reduced and the evaporation of the chlorate solution eliminated.

Against this disadvantage in the indirect method we have the advantage that we obtain another valuable product in the caustic soda. As is shown in a following table, the value of the caustic soda is more than compensating the increased costs of production and further we have the indirect advantage that according to the market conditions, the production can be changed to comprise other products. Instead of caustic soda, caustic potash can be produced without changing the operation and the caustic potash can by carbonation be turned into potash. Instead of chlorate a plant can without radical changes produce liquid chlorine or chlorine products such as hydrochloric acid, bleaching powder in solid and liquid form, sodium hypochlorite, and organic chlorine compounds.

Direct Electrolytic Manufacture of Chlorate.



Annual Costs for the Production of 1,000 Tons of Potassium Chlorate

	Indirect Method		Direct Method	
Potassium chloride	680 tons@$40	$27,200	650 tons@$40	$26,000
Electrical energy	Electrolysis, kw.-yr.	825	Electrolysis, kw.-yr.	775
	Evaporation and electric motors, kw.-yr.	230	Motors, kw.-yr.	25
	Loss of electrical energy, kw.-yr.	225	Loss of electrical energy, kw.-yr.	175
	Total, kw.-yr.	1,280	Total, kw.-yr.	975
	1,280 kw.-yr.@$16	$20,500	975 kw.-yr.@$16	$15,600
Chemicals		$2,700		$2,700
Lime	2,000 tons@$11	$22,000		
Coal	Evaporation of caustic, tons	1,000		
	Finishing melting of caustic, tons	1,250		
	Heating and sundries, tons	250		
	Total, tons	2,500	Heating and Sundries:	
	2,500 tons@$6.70	$16,800	250 tons@$6.70	$1,700
Rock salt	4,250 tons@$5.40	$23,000		
Drums	10,000@$1.35	$13,500		
Graphite electrodes	15,000 kg.@$0.50	$7,500	40,000 kg.@$0.50	$20,000
Labor	48 men@$800	$38,400	25 men@$800	$20,000
Direct production costs		$171,600		$86,000
Repairs		$20,000		$7,000
Interest and amortization		$30,000		$15,000
Overhead charges		$20,000		$10,000
Total production costs		$241,600		$118,000

Value of the Products and Net Income

Indirect Method		Direct Method	
2,500 tons caustic soda@$72	$180,000		
1,000 tons chlorate@$120	$120,000	1,000 tons chlorate	$120,000
Value of products	$300,000	Value of products	$120,000
Costs of production	$241,600	Costs of production	$118,000
Net income	$58,400	Net income	$2,000

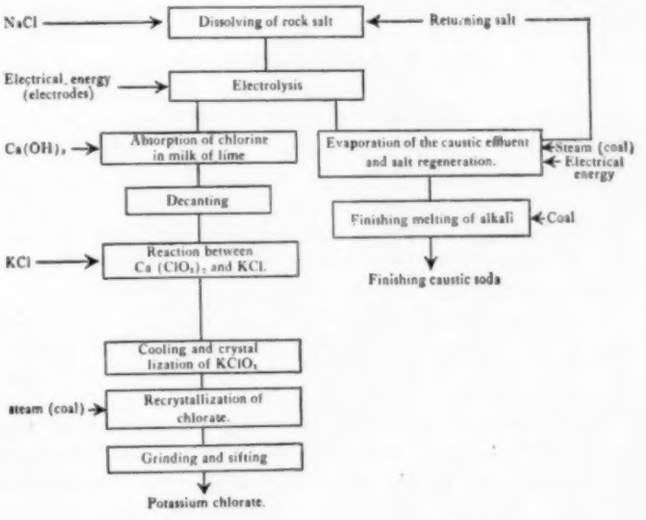
The table below is only to be considered as a comparison of the financial questions concerning the two methods. Even if the conditions might radically change from case to case, the superiority of the indirect method at the prices taken is clearly shown. The costs of the indirect method were obtained from a modern diaphragm-cell plant. The evaporation of the caustic is calculated to take place with electrical energy using the steam-compression method and the finishing melting to take place with producer gas. For the refrigeration of the chlorine solution about 40 hp. is required. In both cases the calculations are made with the use of impregnated Acheson graphite electrodes. The consumption of electrodes is, as shown, greatest in the direct process. If unimpregnated electrodes are used the result becomes still more to the advantage of the indirect method.

At some places magnetite electrodes are used with success, but this is not a controlling cost factor. Interest and amortization, repairs and overhead charges are only approximately given. The prices refer to Swedish conditions and are calculated in dollars. The quantities are in metric tons. The price of the energy is put relatively low.

As previously mentioned, the above prices are those which can be obtained at a plant in Sweden. It ought to be pointed out that the caustic soda in Sweden is protected by a custom charge of Kr. 25 = $6.70 per ton. As is shown the indirect method renders a considerable net income, and expenses are barely met in the direct method. We observe that in the former the value of products has increased two and one-half times compared with the latter, while the cost of production has only increased twice. This result is not surprising if the two processes are analyzed. The direct method is consuming the caustic alkali produced, in the cells, to form the chlorate, while the indirect one is separating and taking care of this valuable product and instead uses the cheaper raw materials, lime and potassium chloride.

The total production costs have as an average increased approximately 50 per cent as compared with the conditions before the War, the wages more than 50 per cent, the raw materials as a rule somewhat less. Concerning the value of the products, that of the caustic soda has increased approximately 50 per cent, while the value of the chlorate has remained almost unchanged. It is therefore obvious that the chlorate production is not as profitable now as before the War, and that the addition of another product, the value of which has followed the price fluctuations, tends to make the result much better. It is further obvious that the method of

Indirect Electrolytic Manufacture of Potassium Chlorate.



producing pure salt as a byproduct of alkali production, the process of which was previously described in *Chem. & Met.*, might in such a case make the final result still more favorable.

The indirect method naturally has the disadvantages of requiring a greater capital than the direct one and further that the operation to some extent becomes more complicated. These disadvantages are however outweighed by far better earnings and the possibility of being able to change the production according to the market situation.

The chlorine problem as well as the difficulties of disposing of the chlorine in connection with the increasing production of electrolytic alkali has been much discussed. From this point of view the indirect chlorate method which produces two and one-half times more alkali than chlorate must be considered as the only rational one. The world consumption of chlorate is, however, insignificant in comparison with that of caustic, but, as the chlorine situation stands today, it must from the point of view of political economy be considered objectionable to produce chlorate in a direct electrolytic way instead of utilizing the excess production of chlorine for this purpose.

At least it must be pointed out that at the present price levels, it pays better to make bleaching powder than chlorate. The chlorate market has always been unstable and several times has collapsed from overproduction. This depends upon the fact that the world consumption is relatively small so that the addition of only one large plant influences the market. There exists, after all, only one great consumer, the match industry, and the greater part of this is ruled by a powerful world trust. Chlorate production by outsiders therefore involves great risk, especially according to the direct method where the manufacturing is limited to only one product.

Sulphur and Waxes Discussed by Oil Chemists

Editorial Staff Report

TWENTY papers, of which five were devoted to sulphur problems and five to waxes, were presented before the Petroleum Division, American Chemical Society at the Richmond meeting, April 12 to 16. W. F. Faragher presided in the absence of R. R. Matthews, regular chairman of the Division.

The first paper on sulphur by Borgstrom and Reid was in the nature of a preliminary report on the American Petroleum Institute project for the study of the identification of sulphur compounds in petroleum. The compounds were classified and a list of references for each was furnished the members. This was followed by a paper by Youtz and Perkins on "The Action of Refining Agents on Pure Sulphur Compounds in Naphtha Solution." Considerable difference was found between various agents when acting on the same compound. Morrell and Faragher reported the action of "doctor" solution in sweetening distillates. Discussion of this paper seemed to show that the action was complex and affected by many variables. The same authors together with G. S. Monroe presented a system for quantitative analysis of sulphur, mercaptans, sulphides, disulphides, and, by difference, residual sulphur.

The first paper on waxes was given by Buchler and Graves. The work on which it was based consisted of separating the various refinery waxes into a series of fractions belonging to the same homologous series, ranging from $C_{18}H_{38}$ to $C_{48}H_{98}$. Photomicrographs of the crystals were shown. C. E. Reistle presented a paper on the relation of paraffin to production problems, also illustrated. French, McGill and Sullivan presented two papers on wax. The first dealt with the heat of solution and advocated the use of 72.5 B.t.u. per lb. rather than the commonly used 63.27 in order to get better results in calculating heat balances on chilling wax distillate. The second concerned the solubilities and indicated that chill and cloud points are unreliable for predicting wax content. A paper on "Wax Crystallization," by Hefley and Padgett covered the crystallography of waxes.

Cracking was discussed in two papers. Schneider and Norris reported laboratory work on cracking normal and isohexane by aluminum chloride and formulated a tentative hyphothesis of the reaction mechanism. Egloff and Morrell presented a paper on "The Cracking of Spindletop Crude Oil." Masson and Drogin spoke on diffusion of petroleum products. Flowers, McBerty, and Dietrich took up the question of purifying used cleaner's solvent by continuous, automatic, chemical processes and showed the savings which could be made.

Herschel pointed out the errors and their magnitudes which were commonly introduced in working with the Saybolt Thermo-Viscometer. Schnetzler demonstrated a slide rule of value where many calculations must be made on flow through orifices.

C. K. Reiman presented the method used by A. D. Little, Inc., for quantitative anti-knock testing. Apparently this method has given reproducible results. The discussion showed that all present greatly favored the adoption of Edgar's heptane-iso-octane scale.

C. S. Cragoe reported on the work in progress at the Bureau of Standards, undertaken to furnish petroleum engineers with tables corresponding to the "steam tables" of the mechanical engineers.

Oil Engine Conference Held at Penn State

At the Oil Engine Conference held at The Pennsylvania State College April 21 to 23, Prof. E. D. Ries of the department of chemistry of that institution spoke on "Oil Power from the Standpoint of the Oil Man." Prof. Ries pointed out that the oil industry is older in years of commercial activity than the engine industry; that it readjusted itself to the change which took place when a demand for gasoline was created; and that its ability to meet this demand was the deciding factor in making these industries what they are today.

Future trends and advances were summed up by Prof. Ries as follows: (1) Up to the present the oil industry has adjusted itself to changes in demand and will do so in the future when necessary; (2) As the use of oil engines becomes more widespread the refinery load will be shifted; (3) There is every reason to believe that there will be sufficient fuel to meet the demand regardless of whether the demand is for light or heavy fractions; (4) Lubricating oil will operate under much more severe conditions, but there is no reason to believe that satisfactory lubricants will not be produced; (5) The best results will be produced by close co-operation between the engine man and the oil man.

Para Cymene as a Thinner for Paints, Varnishes and Lacquers

New application of this solvent should stimulate its recovery from sulphite pulp waste liquor

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PARA CYMENE is obtained as a byproduct in the sulphite pulp industry. It is formed during the digestion of spruce woods by the sulphite liquor, and is blown off, along with other volatile products, with the relief steam from the digesters. When these vapors are cooled and condensed, they yield what is variously known as "spruce turpentine," black liquor or "sulphite turpentine." The appellation turpentine is a misnomer, as the product contains only small amounts of terpenes. The crude material is a dark, oily liquor having a specific gravity of 0.867 at 22.5 deg. C. and when thus obtained possesses a strong odor of sulphur dioxide.

The oily liquor is decanted from the aqueous layer and is then treated with lime, which neutralizes the dissolved sulphur dioxide and combines with other reacting impurities. The crude neutralized liquor is first distilled with steam, which gives a clear colorless distillate. The light upper layer is drawn off and washed with dilute sodium hydroxide to remove the malodorous impurities. After fractional distillation, a product which is practically pure para cymene is obtained.

Para cymene (1 methyl—4 isopropyl benzene) is a colorless aromatic hydrocarbon. Its physical constants as given in the chemical literature are as follows: Freezing point, —73.5 deg. C.; boiling point, 176 to 177 deg. C.; specific gravity, 0.8639 at 15 deg. C.; vapor pressure at 25 deg. C., 7.15 mm. It is completely miscible with the common organic solvents. It is inflammable, but does not flash at ordinary room temperatures. The flash point as determined in the Color Laboratory with a Tagliabue open cup tester is approximately 100 deg. C.

Phillips and Goss [*Chem. & Met. Eng.*, vol. 33, p. 745 (1926)] discovered "that mixtures of para cymene with organic solvents, such as alcohol, acetone, and normal butyl alcohol, are excellent paint and varnish removers." When used alone, however, it is not very effective in such a capacity, having about the same softening action as turpentine. In their tests they observed that "para cymene alone had no effect on varnishes and only a very slight action on paint."

From a consideration of their derivation, and an inspection of their physical properties, it was expected that para cymene and wood turpentine would have some properties in common. Both are derived from wood, although by different processes. The Federal Naval Stores Act recognizes, in addition to gum spirits of turpentine, two kinds of wood turpentine. None of these turpentines is a definite chemical compound, but each is a mixture of compounds having no definite boiling point or specific gravity. The specific gravity of turpentines at 15.5 deg. C. (60 deg. F.) varies usually from 0.860 to 0.875 and the initial distilling temperature varies usually from 150 deg. C. to 160 deg. C. at normal atmospheric pressure. Like para cymene, turpentines are miscible with most organic solvents and are excellent solvents for gums and resins.

Paint mixtures in which para cymene replaced wood turpentine were logically first to be investigated. In order to accentuate the effect of the substitution, more oil and thinner were used than are found in prepared paints complying with Federal specifications. All the experimental mixtures were compared with a control containing linseed oil and steam-distilled wood turpentine. Paints made according to Formula I were first tested by preparing painted slabs of various woods. The results showed that the substitution of para cymene for turpentine hastened the drying action, and produced a flat paint instead of one having lustre. From observation it appeared that both paints had the same covering power. The experimental slabs were allowed to dry for 24 hr. before applying succeeding coats. No evidence of blistering or softening of undercoats was observed in these tests.

Formula I

	FORMULA I *Grams*	CONTROL *Grams*
White lead paste	1,000	1,000
Linseed oil	300	300
Turpentine	none	150
Para cymene	150	none

Preliminary tests were made with many resins, including cumar, damar resin, ester gum, and para cymene resins, prepared in the laboratory by chemical treatment of para cymene. It was found that they were entirely miscible with para cymene up to 9 parts of resin to 1 of solvent. Experiments were then conducted with stains, varnish-stains, and varnishes in which para cymene was incorporated as a thinner. The stains were prepared by dissolving 100 gm. of synthetic BS resin, damar resin or resins derived from para cymene in 30 gm. of para cymene. The varnishes were prepared according to Formula II. Applied to wood surfaces they produced hard coatings which were not as lustrous as controls mixed with wood turpentine.

Formula II

	Grams
Ester gum or equivalent	100
Tung oil	100
Linseed oil	20
Para cymene	150

No evidence of blistering or softening was ever observed in the application of succeeding coats of these varnishes.

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In order to complete the survey of its usefulness to the industry, lacquers derived chiefly from nitrocellulose esters were prepared, para cymene being used as a thinning agent instead of toluol. Preliminary tests were made with practically all the lacquers available on the market. These preparations were thinned down from 10 per cent to 40 per cent with p-cymene and then brushed out on wood slabs. During the process of diluting it was observed that some of the commercial products became gelatinous and could not be used, whereas most of them were miscible with additions of p-cymene up to 40 per cent by volume. Lacquers prepared according to Formulas III and IV were brushed on wood and metal slabs.

Formula III

	Grams
Nitrocotton	32
Amyl acetate	120
P-cymene	75
Tricresylphosphate	0.5

Formula IV

	Grams
32-oz. solution	100
(32-oz. nitrocotton per gallon butyl acetate)	
Damar gum, 50 per cent solution in benzol	90
P-cymene	60
Tricresylphosphate	0.5

When an excess of p-cymene was used, it was found that "blushing" would be produced, as the experimental slabs whitened upon drying. The incorporation of certain resin solutions inhibited the tendency to blush and such additions would produce a clear lacquer coating from mixtures that previously whitened. It was found that successive coats could be applied after a period of 24 hr. without roughening the under surface.

WHEN p-cymene is to be used as a thinning agent in the manufacture of paints and varnishes, it will have to compete against mineral spirits which is the most acceptable low cost thinner. Assuming for the present that it can compete favorably on a cost basis, it is believed that p-cymene possesses qualities which make it more acceptable than mineral spirits. It possesses greater solvent action on resins. Being completely miscible with practically all gums ordinarily used in the trade, it does not throw any of them out on thinning.

Commercial p-cymene is practically a pure chemical, having definite physical constants, whereas mineral spirits vary greatly, according to the producer and to the petroleum used.

Ordinary distillations of p-cymene showed the following temperature relations. 200 cc. material were taken in each case.

	A Deg. C.	B Deg. C.
First drop	173.0	160.0
5 cc.	175.0	173.0
10 cc.	175.0	174.0
50 cc.	175.3	175.0
100 cc.	175.5	175.0
150 cc.	176.0	175.6
175 cc.	177.0	176.0
190 cc.	178.0	177.0
Dry	178.4	179.0

It can be observed from the preceding results that approximately 80 per cent will come over between 175 to 177 deg. C.

No conclusive evidence regarding the penetrating powers of solvents was obtained. (The Henry A. Gardner Laboratory, Washington, D. C., is to continue this work more exhaustively, using different varnish concentrations on various woods, in the interests of the American Paint and Varnish Manufacturers' Association.) The following experiments indicate merely that para cymene and turpentine behave similarly.

Three flat slabs of white pine, ½ in. thick, 4 in. wide and 8 in. long were hollowed out ⅛ in., leaving a 1-in. border all around. Into each of the basins thus formed 5 cc. of one of the following solutions was poured. Thirty cc. of solvent (mineral spirits, turpentine or p-cymene) mixed with 4 cc. of varnish saturated with Typophor Carmine F. B. The solution containing mineral spirits was not as clear as the other two, and upon standing precipitated some of the varnish. The slabs were kept in a horizontal position and were under observation until no free liquid remained. The turpentine solution worked through first, in 40 min., and the mineral spirits and p-cymene required 1 hr. to penetrate. The slabs were cross-sectioned the following day, when it was observed that the wood turpentine and p-cymene followed the grain containing the resinous deposits, whereas the mineral spirits merely seeped down in a more uniform fashion. This may be due to the greater solvent action of the first two thinners for resins. From these results it was believed that p-cymene would be more desirable than mineral spirits in the preparation of paint for priming coats. A paint containing 1,000 gm. of white lead paste, 50 gm. of linseed oil, and 325 gm. of p-cymene was prepared and applied to wood surfaces. It possessed about the same covering power as the pigment prepared according to Formula I. There was, however, distinctly less lustre. Succeeding coats caused no blistering action. Standard paints containing oil and turpentine could be satisfactorily applied to this priming coat.

P-cymene is thrown into competition with toluene as a thinner for the preparation of lacquers derived from cellulose esters. This of course is a more lucrative field for this byproduct. P-cymene is not only miscible with the usual solvents for nitrocotton (butyl acetate, ethylene glycol and amyl acetate), but is also a solvent for the resins which are incorporated in brushing lacquers. Toluene has a lower boiling point (111 deg. C.) and consequently a faster rate of evaporation than p-cymene, but appears to suffer no further by comparison. No distinction could be observed in our tests between the relative miscibility of toluene and cymene with resins. Whether the greater volatility of toluene will tend towards a blistering effect on undercoats should prove an interesting investigation for industrial laboratories.

AT present there is no substantial demand for this byproduct, and consequently few plants have made the necessary installation to effect its recovery. In 1909 the engineering laboratories of the University of Wisconsin attempted to use it as a fuel for internal combustion engines. Innumerable other investigations have followed this pioneer work. The production of toluene from p-cymene was attempted by several investigators [Moore and Egloff, *Met. Chem. Eng.*, vol. 17, p. 66 (1917); Schorger, *J. Am. Chem. Soc.*, vol. 39, p. 2671 (1917)], but the yields thus far obtained would not justify commercial exploitation, except possibly in cases of national emergencies arising from a state of war. A large number of interesting syntheses have been effected from p-cymene; one of particular interest is that of carvacrol (U. S. Patent 1,449,121 granted R. H. McKee). These, however, have proved to have little more than academic interest. In 1918 Dr. C. H. Herty [*Ind. Eng. Chem.*, vol. 10, p. 1, (1918)], writing editorially in the *Journal of Industrial and Engineering*

Chemistry, stated that from 1,500,000 to 2,000,000 gal. of "spruce turpentine" was going to waste annually in the United States and Canada. Realizing the magnitude of this economic waste, he deplored the fact that no profitable demand for it had yet been found. Almost ten years has elapsed since that writing, and today almost the same situation confronts the manufacturers of sulphite pulp.

According to statistics of the United States Department of Commerce, 3,071,361 cords of domestic and imported spruce woods was treated in this country during the year 1924, from which it is estimated that a yield of 1,400,000 tons of pulp was obtained. Authorities differ as to the possible yield of p-cymene per ton of pulp. The figures range from 0.36 to 1 gal. Assuming that the recovery is 0.6 gal., the possible annual production of this byproduct in the United States alone would be about 850,000 gal. The Canadian mills should, according to estimates, be able to augment this production by almost 500,000 gal., thus making possible a total annual production of 1,300,000 gal. This is only a small fraction of the paint and varnish thinner requirements of this country, as 7,500,000 gal. of turpentine alone was used, to which must be added several times as much mineral spirits.

Two factors are involved in the commercial aspects of the problem: (1) The installation of equipment necessary to recover and purify the crude oily liquor, and thus insure to the paint and varnish industry a definite supply of p-cymene; (2) the organization of producers into groups to make possible such a low cost of production that p-cymene can compete with mineral spirits in paints and varnishes and with toluene as a lacquer thinner.

IT is manifest that the first move towards developing an industry, for the recovery of this economic waste must come from the paint and varnish industry. All expenditures in this direction would be predicated upon the approval and acceptance of p-cymene as a paint and varnish thinner. The assurance of a definite market and the probability of tangible returns on investments made will encourage the mill operators to make a small initial expenditure. This will provide for the installation of atmospheric or surface condensers to simply condense and recover the cymene-bearing relief gases. No great engineering skill is required for the installation of such apparatus. The condensate comprises, in addition to the "sulphite turpentine," a large quantity of water containing a number of dissolved substances. This condensate is led to vats where it is treated with lime and stored until a sufficient quantity is on hand. The lighter p-cymene liquor rises to the top and can be periodically decanted or syphoned off. It can then be loaded into tank cars for delivery to a central rectifying plant. Specifications may be drawn up for the crude product, so that each mill can be credited for its deliveries at a definite price or on a co-operative basis.

The rectifying plant would include tanks for raw liquor, process material, and refined p-cymene. A continuous column still can be utilized to steam-distill the crude oil. The p-cymene is decanted from the clear distillate. It is then thoroughly washed with dilute sodium hydroxide and subjected to fractional distillation without steam. The caustic soda solution may be used over and over in order to minimize the expense of purification. The p-cymene thus obtained has the physical constants previously noted. These constants may serve as a basis for establishing specifications for this material as a thinning agent.

From the foregoing description of the plant required for the preparation of p-cymene, it is evident that its production technique is simple. In fact, it is more easily accomplished than the treating of petroleum for mineral spirits. Such an installation requires only meagre supervision and yet works most satisfactorily. It is furthermore highly probable that some of the larger manufacturers of paper pulp have existing plants in which they can not only recover their own p-cymene, but can also receive outside material for purification.

IT is manifest that the first move towards develop- the relief vapors should be practically negligible. Only a moderate investment is required for vats to store the crude "sulphite turpentine." The erection of a rectifying plant will involve the expenditure of a sum which in the business world may be considered a substantial investment. When it is realized, however, that a single distillation plant can serve a large number of mills, such a co-operative undertaking presents no serious obstacles. It is estimated that three rectifying plants, located at strategic points, can readily purify the American production while operating on a day shift only.

Laboratory tests have shown that it is possible to obtain a yield of at least 85 per cent on the steam distillation of the crude oil, and a yield of 97.5 per cent on the final rectification. They also show that less than 4 parts of steam are needed to effect the steam distillation, whereas 1.5 parts would be required during the rectification, if it is accomplished with high-pressure steam as a heating medium. The use of fuel oil as a source of direct heat during the final distillation should lower this item of expense.

It is now possible to calculate the steam requirements and to compute its cost per unit of p-cymene produced. To be conservative, it is assumed that 6 parts of steam are required for 1 part of pure marketable product. On this basis 100 gal. (714 lb.) of para cymene will require 4,284 lb. of steam. When this is introduced at 40c. per 1,000 lb., its cost per 100 gal. of finished product is $1.71. This is probably the largest item in operating expense. It would be futile to attempt to give any accurate figures for the net cost of production without exact knowledge regarding the layout of the plant and its productive capacity, but for the sake of inviting comment the following estimates, expressed as cents per gallon, are tabulated:

Steam and other power	3.0
Lime	1.0
Caustic soda	1.0
Direct labor and supervision	2.0
Overhead, interest on investment and depreciation	3.0
Total	10.0

PARA cymene has been found to be a satisfactory thinner in the preparation of paints, varnishes and lacquers. Until now it has been a waste product of the sulphite pulp industry in the treatment of spruce woods. It is believed that the market opened by the discovery of its usefulness as a paint and varnish thinner will justify the installation of equipment to effect its recovery.

Producing Agar from Californian Seaweeds

Substitution of chemical engineering for crude methods of foreign competitors establishes domestic industry and breaks monopoly

AGAR is the commercial name applied to the dried gelatinous extract of certain species of red seaweeds, those producing the finest product being *Gelidium Cartilagineum, Gelidium Coulteri* and *Gelidium Corneum*. All these species are native to California and to the shores washed by the Japanese current.

Animal gelatine is a nitrogenous substance extracted by hot water and having the property of jellification at a lower temperature. Agar—as it is known in the United States, although the official name is agar-agar—is practically non-nitrogenous, prepared in solution as is animal gelatine, but it is of vegetable origin, being made from seaweed. Agar is therefore a vegetable gelatine. Agar has also been called a vegetable isinglass, which is illogical, because isinglass is a specific form of animal gelatine made from the sturgeon.

American agar is a water-soluble colloid having the following typical proximate analysis:

Moisture	18.41 per cent
Protein (N × 6.25)	1.12 per cent
Nitrogen-free extract	76.94 per cent
Ether extract	0.19 per cent
Crude fiber	0.14 per cent
Ash	3.20 per cent

A sample of American agar with 16.7 per cent moisture yielded 3.48 per cent ash, which on analysis was found to comprise SiO_2, 0.93 per cent; Fe_2O_3 and Al_2O_3, 0.04 per cent; MnO, 0.01 per cent; CaO, 0.77 per cent; MgO, 0.41 per cent; B_2O_3, trace; Na_2O and K_2O, 0.23 per cent; CO_2, 0.03 per cent; SO_3, 1.03 per cent; P_2O_5, 0.01 per cent; Cl, 0.01 per cent; and undetermined, 0.01 per cent. Agar is easily soluble in boiling water, the liquid phase being considered a solution of agar in water. It forms a jelly on cooling. Coagulation may be effected at a dilution of even 500 to 1.

Agar, like gelatine, behaves in a manner unaccountable by known laws. No definite scientific conclusions seem to have been reached in regard to structure, variations in physical characteristics and varying absorptive properties under different conditions. However, agar has been recognized as so important an aid in personal hygiene, as a peristaltic stimulant and intestinal lubricant, and has proved so ideal a medium in biochemical research and bacteriological control, that it will be of interest to review the changes of physical composition that have followed the scientific selection of raw material and details of a systematized and precise method of manufacture.

Until the establishment of a domestic industry, by the American Agar Co. at San Diego, Calif., all the agar used in the United States came from Japan, where it is prepared by crude methods from a variety of seaweeds, thereby accounting in large measure for the lack of uniformity. In Japan the seaweed is washed with fresh water, bleached in the sun, and then cooked in open kettles. The resulting liquor is strained and flowed into shallow pans, where it jellies upon cooling. The crude agar is cut into strips and exposed to the low night temperatures, whereby surface freezing of the contained water is effected, followed in the day time by thawing and evaporation in the sun. In the United States this crude agar is purified and sold in various forms as a refined Japanese product.

The domestic industry in the United States, recently developed in Southern California, uses only one type of seaweed—*Gelidium*. This is indigenous to the region and is found from tide level to a depth of 60 ft. It is a prolific breeder, quickly replacing itself after being harvested. Many trials at company control of the initial harvesting operations preceded the wise decision to encourage the picking, drying and baling of the weed as a supplementary occupation for fishermen and divers, from whom it is now purchased. The characteristic red color of *Gelidium* facilitates selection and permits a fairly close control of impurity. It is dried by atmospheric exposure, then baled and delivered to the plant, where it is stored until used.

The first step in processing is washing. For this purpose the seaweed is submerged in wooden tanks, through which flows a stream of fresh water for 24 hr. The seaweed is then transferred by fork to a wire basket, which is carried by overhead crane to one of five digesters, each holding about 1,200 gal. and provided with internal steam coils. An intermittent displacement system of solution treatment is employed. The drainpipes from the digesters are connected with a centrifugal pump. The fresh weed is treated for about 6 hr. with an agar solution that is pumped from the vat next in series, in which contact was maintained for about 8 hr., the solu-

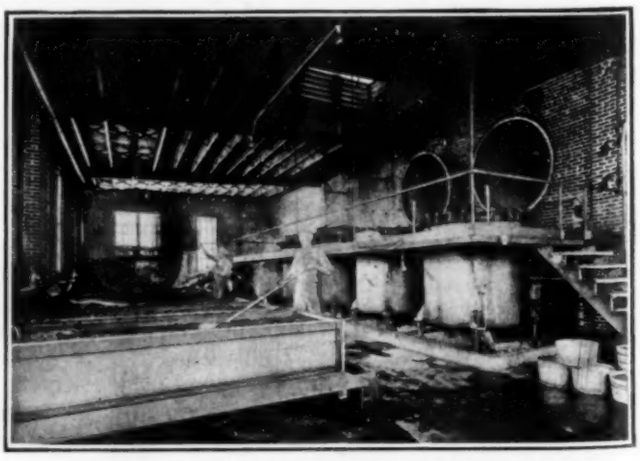


Fig. 1—Washing Tanks and Loading Basket on the Left; Digesters on the Right

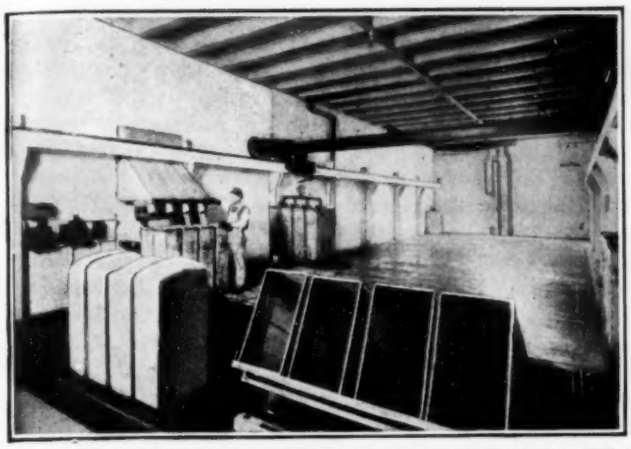


Fig. 2—The Freezing Room, Showing Freezing Cans Being Filled and Blocks of Frozen Agar and Ice Ready for the Crusher

tion used being formed in the vat next in series by contact for 12 to 14 hr. of water and nearly spent seaweed. The process as practiced thereby insures a progressive concentration of solution and a corresponding impoverishment of the seaweed.

The crude liquor from the digester is pumped to a mixing vat with propeller agitator, to which is added a filter-aid and charcoal. In the meantime the cloths in a small plate and frame filter press are coated with a layer of filter-aid, previously pulped in hot water. The hot, decolorized agar solution is then passed through the press and sent to a vacuum evaporator which removes some of the water.

The jelling of the agar liquor by cooling was formerly done in open pans, the product being fed to a large machine with perforated discharge and revolving cutter knife, the speed of which could be regulated to sever the extruded product into small pieces of any desired length. This method has recently been superseded by an ingenious process whereby jelling is effected in a few seconds. The machine is essentially a cylindrical chamber inclosing a nest of horizontal tubes. The space at the head of the machine serves as an inlet chamber for the hot liquor, which passes into the tubes by reason of pump pressure and the controllable revolution of a disc-plate valve of novel design. The tubes, which are surrounded by circulating cold water, are thereby filled in regular sequence. At the discharge end of the machine the tubes are open to the atmosphere when exposed thus by the revolution of a cutter valve. In operation therefore, the inlet valve permits the entry of hot solution into the tubes in regular sequence, this hot solution pushing forward the agar that has jelled since the previous revolution. As it emerges from the ends of the tubes, the gel is cut into cylindrical pieces of a required length by the cutter valve.

Despite the fact that the jelled agar contains approximately 98.5 per cent of water at this stage of processing, the size of the pieces cut automatically from the machine determine the particle size of the ultimate agar product. The cut agar gel, in small cylinders is discharged into a hopper and passes through the wall into the freezing room, where it falls into standard ice-making containers.

In the freezing process the solubles crystallize, thus separating from the insolubles. Freezing and thawing constitute the only practicable means of dehydrating a gel of this kind. A block of frozen agar in the ice room weighs about 300 lb. and contains from 3 to 6 lb. of the commercial dried product (5 per cent moisture).

The frozen block of agar passes through a specially constructed crusher en route to the thawing tank where, with the addition of fresh water at atmospheric temperature, an almost instantaneous thaw and wash is produced. From the thawing tank a stream of water and suspended agar goes to a rotary vacuum dewaterer, equipped with Monel-metal screen of 100 mesh. It is here that the last traces of soluble impurities are extracted, and a further wash while under the vacuum insures the purity of the product leaving the insoluble product, agar, in flakes ready to be charged into the dehydrators, and carrying about 90 per cent moisture. On the drum of the dewaterer the agar forms a layer that may be an inch or more thick. The operation is unusual because of the small proportion of solids.

The dehydration of this product, to produce a marketable and efficient agar of constant chemical and physical properties and of high water-absorbing power, involved a problem of considerable magnitude. Ordinary drying methods were clearly impracticable, because of the tendency to case-harden the material and prevent the release of moisture from the interior. Final plans involved drying in two stages, and the adoption of the principle of air flotation as a means of classifying dried from undried particles. The product of the dewaterer passes, via a short screw conveyor that constitutes a seal, into the lower part of the first, humidity-drying chamber, consisting of a vertical cylinder of aluminum, 35 ft. high and 3 ft. in diameter, supplied at the bottom with clean hot air by blower and steam radiator pipes.

In this first dehydrator the agar is kept in suspension in a moist atmosphere until it is light enough to be carried to the top and to pass into a fabric down-pipe, through the interstices of which the moist air escapes. The semi-dry agar is trapped at the bottom and delivered into a second screw conveyor, also acting as a seal, and connecting with a second vertical chamber the same size as the first, in which dehydration is concluded. Glass windows in these drying units disclose what appears to be a miniature snow storm, the upward pressure of heated air being regulated so that the material passes forward only when it is dry enough and light enough to be carried upward the required height. From the final fabric down-pipe the

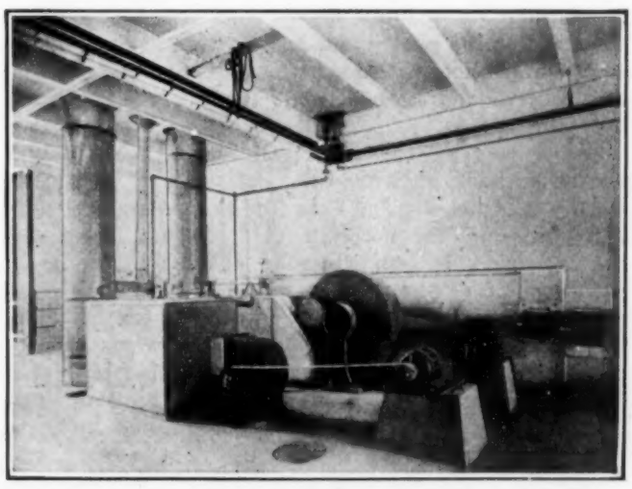


Fig. 3—The Lower End of the Dehydrating System



Fig. 4—The Warehouse, Showing the Sizing Equipment and the Bag Sewing Machine

agar passes to sacks for packing. It is shipped in bulk as well as in water-proof paper bags containing 5 lb., somewhat the same size as a sack of cement.

For ordinary water absorption purposes the rough product is used. But agar is coming into wide use for a multitude of purposes as an auxiliary food product; and in such cases a finely-ground agar, easily dissolved in boiling water, is used. This is prepared by passage through a swing-hammer mill which is equipped with suction fan and cyclone collector. The product averages 35 per cent through 100 mesh, some being 60 mesh. The finely-ground agar has proved an excellent material for cultures, and for use in candies (especially marshmallow), jellies and for other purposes for which animal gelatine is now employed. The source of the raw material and the sanitary methods of manufacture insure freedom from high bacteria content. Furthermore, exhaustive laboratory tests show that the water absorption is markedly greater than that of the Japanese product.

To date, standard agar has been defined in terms of the purified Japanese product, but a change in standardization is imminent. The following data are of interest as providing information on the physical characteristics of the new American agar and illustrating the quality of the product as compared with that of the refined Japanese product, which to date has been the only agar obtainable.

A characteristic property of agar is its ability to absorb and hold many times its own weight of water and the specific quantity of water absorbed is a direct indication of the purity and value of the agar. This is also an important characteristic as many of the industrial uses of the agar depends upon its capacity for absorbing water. Various attempts have been made at the laboratory of the American Agar Co. to obtain numerical values showing the relative water absorbing capacity of American and Japanese agar. Simple though it may appear, the determination of this factor has been attended by considerable difficulty, chiefly in segregating the water held mechanically by the agar from that which is physically absorbed. In tests developed, the water absorption capacity or water absorption coefficient is defined as the number of unit weights of water absorbed and held per unit weight of agar. Careful tests carried out on the American and Japanese agars have shown the superiority of the American product in water absorption capacity. This is especially noticeable at 100 deg. F. where the contrast is greater than at ordinary room temperature.

A greater absorptive capacity is reflected in the swelling power. The Japanese agar tends to settle in the bottom of the container, leaving a distinct layer of supernatant water. The American agar swells so that it forms a uniform mass throughout the entire volume and no such distinct layer of excess water is observable. A six per cent solution of American agar prepared and allowed to congeal, when grated in small particles and hung in a small bag in a beaker of water increased 82.5 per cent in weight after the excess water was removed.

It has been shown that pure agar is tasteless and that the taste found in the imported agar is due to the impurities present. Hence the purity of the agar may also be judged by its taste. A further test of purity is the iodine test. Such a test was made on the American and Japanese products by the addition of iodine to an aqueous suspension of the agar. The refined Japanese agar immediately showed the deep purple color of the starch iodide reaction, while in no case was this color obtained in the American made agar. The purplish flakes of this refined foreign product when mixed with the American agar still retained the purple color, none of which was imparted to the other, showing that the substance causing the starch iodide reaction is insoluble in cold water.

For assistance in writing this article we are indebted to John Becker, general manager, and to F. W. Weitz, chief chemist of the American Agar Co.

Glycol Dinitrate in Dynamite Manufacture

Quantity production of glycol makes superior raw material available to the explosives industry

By Wm. H. Rinkenbach
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THE latest development in the manufacture of dynamites has been the introduction of ethylene glycol dinitrate to replace part of the nitroglycerin. This has been desirable for economic and technical reasons. The economic advantages arise from the fact that glycol is a synthetic product and is not dependent on the fat and soap industry as is true of glycerin. The technical advantage is due mainly to the value of glycol dinitrate in producing low-freezing dynamites. At present it replaces the nitropolyglycerin used to obtain this effect, and as nitropolyglycerin is manufactured from glycerin, the use of glycol dinitrate renders the dynamite industry more independent of the glycerin supply and market.

Ethylene glycol dinitrate, $\begin{matrix} H_2C\text{-}NO_3 \\ H_2C\text{-}NO_3 \end{matrix}$, has long been known to be explosive. It was discovered by Henry [*Berichte*, vol 3, pp. 529-533 (1870); *Ann. chim. et phys.* (4), vol. 27, pp. 243-264 (1872).] in 1870, but inasmuch as glycol itself was a relatively rare and expensive substance until recent years, no immediate practical use was made of this knowledge. It was not until 1904 that a patent [D. R. P. 179,789 (1904)] covering its use as an explosive was granted, but it was about ten

Published with the approval of the Director, U. S. Bureau of Mines.

years later before its actual use in explosives is recorded. [*Mem. poud. saltpetres*, vol, 16, pp. 214-215 (1911)]. Little was known of its physical proprieties and the extension of its use was retarded by the cost and scarcity of glycol.

THE use of glycol dinitrate on a large scale then, was compelled to await the development of new or cheaper methods of manufacturing glycol, and research on this problem was carried out in many places. The saponification of glycol monchlorhydrin (French Patent, 458-733, Aug. 13, 1912) was proposed, but the utilization of more easily obtainable raw materials was necessary. In 1916, A. Hough patented (U. S. Patent 1,206,222, March 28, 1916) a method of dehydrating ethanol, chlorinating the ethylene formed, and hydrolyzing the ethylene dichloride to glycol. Bono [*Annuario di Chimica*, vols. 25-6, pp. 212-223 (1920)] studied the same process. O. Matter (U. S. Patent 1,237,076, Aug. 14, 1917) patented a method of carrying out such a hydrolysis. Brooks and Humphrey [*Ind. Eng. Chem.*, vol. 9, pp. 750-751 (1917)] also described a method of hydrolysis and patented (U. S. Patent 1,215,903, Feb. 13, 1917) a method to produce the dichlor compounds by the chlorination of oil gas. J. Barab (U. S. Patent 1,307,033, June 17, 1919) mentioned oil gas as a source of supply. Rodebush described the preparation of glycol from ethylene dichloride (U. S. Patent 1,402,317, Jan. 3, 1922) and from glycol diacetate (U. S. Patent 1,454,604, May 8, 1923) by hydrolysis. With the recent developments in the chlorination of natural gases, the production of glycol at a cost somewhat comparable with that of glycerin became a reality.

It is only during the past few years then, that the utilization of glycol dinitrate became economically feasible, and it is to be noted that this was due largely to research and development in a rather unrelated field.

At the present time glycol dinitrate is being substituted in part for nitroglycerin by a number of manufacturers, and present indications are that this use will grow to considerably greater proportions. This is indicated by the fact that to date the Bureau of Mines has approved of 25 explosives containing glycol dinitrate as being permissible for use in coal mines.

Such substitution depends upon the possession by glycol dinitrate of physical and chemical advantages over nitroglycerin, as well as economic equality or superiority. Until recently but little quantitative data concerning the properties of glycol dinitrate were available in the literature, but a study carried out in the Explosives Chemical Laboratory of the Bureau of Mines by Rinkenbach [*Ind. Eng. Chem.*, vol. 18, pp. 1195-1197 (1926)] shows that this compound possesses some distinct advantages when compared with nitroglycerin.

Freezing point. Glycol dinitrate freezes at —22.75 deg. C., as compared with 13 deg. C. for nitroglycerin. Both are subject to some supercooling before crystalization takes place. Explosives made with this compound will be safer for use under ordinary winter conditions than those made with nitroglycerin, and those made with a mixture of glycol dinitrate and nitroglycerin should have lower freezing points than those made with mixtures of nitroglycerin and nitropolyglycerin.

Viscosity. Glycol dinitrate is much less viscous than nitroglycerin. At 23.6 deg. C. it is about eight times as fluid as the latter. This is advantageous in respect to handling on a large scale, but, when used in larger proportions, may prove to be a disadvantage due to exudation from dynamite "dopes." The viscosities, in c.g.s. units at the above temperature are: Glycol dinitrate, 0.0363; nitroglycerin, 0.288. Moreschi [*Rend. della R. Accad. Lincei*, vol. 28, pp. 393-7 (1919) reported results which, on plotting a curve, give values of 0.0399 and 0.31, respectively, at the above temperature.

Specific gravity. Nitroglycerin has a specific gravity [Perkin, W. H., *Jour. Chem. Soc.*, vol. 55, pp. 680-749 (1889)] of 1.6009 at $\frac{15 \text{ deg.}}{15 \text{ deg.}}$, and that of glycol dinitrate is 1.4962 under the same conditions. Because of its lower specific gravity, glycol dinitrate has a tendency to separate from spent nitrating acids more readily than does nitroglycerin.

Reaction on explosion. When pure nitroglycerin is completely exploded the reaction is:

$$4C_3H_5(NO_3)_3 = 10\,H_2O + 6N_2 + 12\,CO_2 + O_2$$

and with glycol dinitrate the reaction is:

$$C_2H_4(NO_3)_2 = 2\,H_2O + N_2 + 2\,CO_2$$

Heat of combustion. The heats of combustion at constant volume (water, liquid) are 1763.9 cal. per gm. for glycol dinitrate and 1630.4 cal. per gm. for nitroglycerin, by calorimetric determination. Calculated values of importance from the viewpoint of explosives are as follows:

	Temp., *t*, of Explosion Deg. C.	Liters of Gas Produced from 1 Kg. at 760 Mm. and 0 Deg. C.	Liters of Gas Produced from 1 Kg. at 760 Mm. and *t* Deg.	Pressure in Kgs. per Cm.² When 1 Kg. Is Exploded in 1 Liter	Meter-Kilograms Developed on Explosion of 1 Kg. of Materia
Glycol dinitrate	4209	736.93	12,099	12,498	695.7×10^6
Nitroglycerin...	4177	715.53	11,663	12,048	647.8×10^6

For the calculation of these values, a heat of formation of 57,850 calories per gram of gaseous water was used. The temperature of explosion was calculated by Henderson's diagrammatic method (using the values for the specific heats of gases derived by the extrapolation of those given by Partington and Shilling). The pressure value was found by the usual formula. These results show that glycol dinitrate has a slightly lower temperature of explosion than nitroglycerin and also gives rise to slightly smaller gas volume and pressure at the maximum temperature. From a thermochemical viewpoint these compounds may be considered as being virtually equal on the basis of equal weights.

Hygroscopicity. Like nitroglycerin, glycol dinitrate is non-hygroscopic.

Vapor Pressure. The vapor pressure of glycol dinitrate, 0.0565 mm. of mercury [*Ind. Eng. Chem.*, vol. 18, pp. 1195-1197, 1926)] at 22 deg C., is about 150 times as great as that of nitroglycerin at the same temperature. Moreschi [*Rend. della R. Accad. Lincei.*, vol. 28, pp. 393-7 (1919)] reported 0.3 mm. for glycol dinitrate at 20 deg. C., but used the static method in determining this. Although this might appear to be a serious disadvantage, it should be remembered that this represents a low degree of magnitude; and although this property may make the toxic effects of glycol dinitrate, which are similar to those of nitroglycerin, more noticeable in the course of manufacture, it is doubtful whether any appreciable deterioration on storage in the form of dynamite will be found. Accelerated storage tests at 33 deg. C. for ten days gave no indication of deterioration.

Sensitivity to Impact. The samples tested indicate that glycol dinitrate is less sensitive to impact than nitroglycerin or a mixture of nitroglycerin and nitropolyglycerin. The minimum fall of a 500-gm. weight causing the explosion of each liquid was: Glycol dinitrate.

110 cm.; nitroglycerin, 70 cm., and nitroglycerin and nitropolyglycerin mixture, 90 cm. This is an important advantage in favor of the use of glycol dinitrate.

Toxicity. No study has been made of the toxic effects of glycol dinitrate when the vapors are inhaled or the liquid absorbed through the skin. From experience in handling in the laboratory, when subjected to these conditions, the writer is of the opinion that these effects are similar to but no worse than those of nitroglycerin and probably are less prolonged.

Solubility effects. Inasmuch as glycol dinitrates is soluble to the extent of 6.8 gm. per liter of water at 20 deg. C., and only 1.8 gm. of nitroglycerin is dissolved under the same conditions, it is to be expected that a lower yield will be obtained in the course of manufacture. However, the possibility of nitrating and washing at low temperatures offers a method of decreasing this loss.

Effect of Sulphur in Liquid Fuels

By H. L. Dunlap
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WHEN free sulphur is dissolved in the heavier petroleum fractions and heated to 210 deg. C., it begins to take hydrogen from the hydrocarbon and form hydrogen sulphide, leaving an olefine. This is easily demonstrated by heating a 1 per cent solution of free sulphur in kerosene or melted paraffin. When the oil reaches a temperature of 210 deg. C., hydrogen sulphide can be detected by lead acetate paper. At the same time, the oil in the flask begins to darken. As the temperature is raised, the rate of evolution of hydrogen sulphide increases and the contents of the flask becomes almost black. Almost quantitative yields of hydrogen sulphide can be obtained by heating to 300 deg. C. a solution of 1 per cent of free sulphur in kerosene. The same was found to be true when free sulphur was dissolved in ordinary solid paraffin and in samples of automobile engine oils and heated to the above temperatures.

Freshly precipitated ferrous sulphide was purified by washing with alcohol and then heated to 100 deg. C. with sulphur-free toluene to remove all possible traces of free sulphur. A part of this sulphur-free ferrous sulphide was then transferred to a flask containing an automobile engine oil and another to a flask containing molten paraffin. Both were then heated to 340 deg. C. for about 2 hr. Small quantities of hydrogen sulphide were obtained in each case, and the contents of both flasks became almost black. Both solid residues, when washed free of oil, were found to be magnetic. This magnetic property could be due to either free iron or Fe_3S_4, but in either case, free iron would be formed according to the equations:

(1) $4FeS \rightarrow Fe_3S_4 + Fe$.

(2) $FeS + R\text{-}CH_2CH_2R \rightarrow Fe + R\text{-}CH{=}CH{-}R + H_2S$.

From the fact that hydrogen sulphide was formed in detectable amounts, the second equation evidently plays a part in the reaction.

Sulphur in distilled petroleum fractions is probably in a combined state. In cheaper and less carefully refined products, it exists as mercaptans, alkyl sulphides, thiophenes, etc. But in combustion with a slight deficiency of oxygen, the sulphur would be left free in the combustion chamber, because the heats of combustion of carbon, hydrogen and sulphur are as follows:

Carbon	14,647 B.t.u. per lb.
Hydrogen	62,100 B.t.u. per lb.
Sulphur	4,034 B.t.u. per lb.

Some of this free sulphur comes in contact with the lubricating oil on the cylinder walls where the following reaction takes place:

$S + R\text{-}CH_2CH_2R \rightarrow R\text{-}CH{=}CH\text{-}R + H_2S$.

The formation of a diolefine could follow and hence polymerization to asphaltic substances. These gummy asphaltic compounds cannot be volatilized without decomposition, but before their final decomposition these gums would collect dust particles brought in with the air. The final residues will then be "carbon deposits" composed of free carbon, dust particles and iron from equations (1) and (2). The formation of ferrous sulphide, of course, would be in minute quantities on the friction surfaces of the cylinder. But the hot lubricating oil would reduce or partially reduce it, the worst effect being to corrode the cylinder friction surfaces. Also, ferrous sulphide is extremely sensitive towards oxygen. It is possible that small quantities on the cylinder walls might cause premature ignition on the following compression stroke when the engine is overheated.

Thus, from a chemical point of view, a small amount of sulphur in a fuel oil is capable of causing much trouble from gumming, carbon deposition and corroding the friction surfaces of an engine. With the proper mixture of oil vapors and air, the sulphur will be burned to sulphur dioxide and expelled from the exhaust. With a deficiency of air in the explosion mixture, the use of the best grades of lubricating oil will be but little better than the use of the cheapest grades.

Attempts have been made to utilize cheap untreated fuels in tractors in some sections of the country and much difficulty has been met. The sulphur has been instrumental in causing the lubricating oils to break down, resulting in excessive wear and even serious damage to the engines.

Effect of Various Gases on Refractory Materials

The effect of chlorine, sulphur dioxide, and carbon monoxide on magnesite, chrome, diaspore, low-iron clay, high-iron clay and silica refractories is described in Bulletin No. 9, issued by the American Refractories Institute, Pittsburgh, Pa. Among the results shown in the bulletin are color changes that take place in the various refractories as the result of gas exposure. A plate reproducing the color changes discloses information that appears to be entirely new.

Considering in a general way the effect of gases upon the strength of the materials, it is disclosed that carbon monoxide is more destructive than chlorine and sulphur dioxide, with the exception of the chlorine-treated chrome and magnesite. The diaspore showed the most inert characteristics toward the three gases. A slight increase in strength was noted when chrome is treated with sulphur dioxide, and the action of this gas on magnesite caused a 30 per cent increase in strength. These increases in strength are not fully explained.

Industries of SOUTHERN OHIO *Characterized by Variety*

By R. S. Tour
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and
Charles H. Behre, Jr.
Executive Secretary, Resource Survey, University of Cincinnati



THIS RESUMÉ of the industries of Southern Ohio has, for the most part, been gathered from, and through the courtesy of, the "Resource Survey" staff of the University of Cincinnati. The university has undertaken this survey under the sponsorship and with the financial assistance of the Commercial Club of Cincinnati and of the Union Gas & Electric Co.

Southern Ohio is characterized by the development of chemical and metallurgical industries of great diversity. Its importance in chemical manufacturing is well brought out by a comparison of the capital invested in chemical industries in three of its leading cities with that of the entire state. In the eastern portion of Southern Ohio capital is chiefly engaged in developing the iron and steel industries; in the western section the manufactures are largely finished chemical products such as paints, dyes, soap, and drugs, and the metallurgical interest lies in foundries and in the preparation and use of lead, copper and zinc alloys.

The eastern industrial district of Southern Ohio centers around Wellston, Ironton, and Portsmouth and in it may properly be included some cities in northern Kentucky, such as Ashland. In the western district, Cincinnati, Springfield, Dayton, and Middletown are conspicuous manufacturing towns. Columbus, being on the border between Southern and Northern Ohio, is not included.

There are three byproduct coke ovens in the eastern district,—at Ashland, Ironton, and Portsmouth. These supply the furnaces and mills in the adjacent Ohio Valley iron centers and ship to Columbus and Middletown as well. A small byproduct plant is operated intermittently at Hamilton.

Blast furnaces are located at Wellston, Jackson, Ironton, Hanging Rock, Ashland, and Portsmouth in the southeastern part of the state, and four stacks are operated at Columbus.

Southeastern Ohio has few chemical works, but in the Miami Valley such industries are numerous. Several large mills for the manufacture of sized and unsized paper and cardboard boxes are located at Hamilton and Dayton, among which is one of the most complete of its kind. There are also two large composition-roofing manufacturers who use considerable quantities of paper stock.

The importance of the fine chemical industries in southwestern Ohio is well shown by the following table based on the Census of 1920:

Comparison of Invested Capital in Chemical Industries

	Total Capital Invested in Industry	Capital Invested in Fine Chemical Industries	Per Cent of Total Invested in Chem. Ind.
Southwestern Ohio (prominent cities only)	$444,256,378	$41,128,999	9.26
Ohio and Indiana	5,084,458,099	197,183,925	3.88

These figures do not include the very large sums invested in soap-making, one of the leading businesses of Southern Ohio. Data as to the capital invested in the soap industry are not available, but Cincinnati firms alone are said by a competent authority to have a yearly output worth more than a hundred million dollars. Especially prominent is the main plant of one of the world's largest companies, but there are in addition three other large soap factories.

Six good-sized chemical plants, a glue works, and a large candle company all represent noteworthy users of grease and animal products in the southwestern Ohio district. Among the prominent industries are five fertilizer works, several producers of storage batteries, and a powder plant. Dyes and paints are another important item, aniline derivatives being a leading product.

Southwestern Ohio is the tanning district of the state. In 1919 over 57 per cent of the total Ohio capital invested in tanneries and related establishments centered around Cincinnati; the value added by manufacture amounted to five and a quarter million dollars in this alone, as against six million dollars for the whole state.

The Southern Ohio district is not exceptionally rich in mineral wealth, but its manufacturers are favored by the relatively short distances to the more important of the raw materials. Southern Ohio lies more or less centrally with regard to a varied assortment of minerals, and this location permits the large chemical user to develop along many different lines.

The fact that the district is on the fringes of several large sulphuric acid-producing regions (Tennessee, Northern Illinois, and Eastern Ohio) and the consequent inter-district competition, make for a fairly constant "buyer's price." One sulphuric acid plant is located at Cincinnati, but has to import its raw materials,—zinc sulphides from the Mississippi Valley mines and sulphur from Louisiana. The attempt to use "coal brasses" as a source of sulphur dioxide failed because of difficulties in cleaning and storing. Had it been successful, the region here discussed would have been exceptionally favorably placed for the development of acid plants.

An important prerequisite in the making of many heavy chemicals is lime. Small areas of high-calcium limestone occur in northeastern and north-central Kentucky, and in southwestern Ohio (Dayton). In the Bedford, Indiana, district is a high-calcium stone available to chemical plants in Western Ohio. A broad belt of high-calcium lime extends southward from Lake Erie to Columbus. On the whole, however, the southern part of Ohio and the contiguous territory are not especially favored with high grade chemical lime. With increased demand the southeastern part of the state will probably draw on the rather scattered limes of the coal-bearing strata. In the southwestern country it is not unlikely that limestone mining will be resorted to.

Among salt-producing states, Ohio ranks third, being exceeded only by Michigan and New York (1925). There are two salt districts,—one in northeastern Ohio, the other in the southeastern counties, centering around Pomeroy and Syracuse. In the latter region the salt comes from brines encountered at depths varying between 300 and 1,600 feet. Important by-products are bromine and calcium chloride. The especially favorable factor for the development of the Pomeroy district is the presence of nearby coal fields.

The barytes shipped into Southern Ohio is produced in Tennessee, Georgia, and Missouri; from time to time a little is brought in from the Blue Grass region of central Kentucky.

Phosphate rock, though not actually occurring in the region described, is available in moderate amounts in central Kentucky and in large quantities in Tennessee, from which it enters the Southern Ohio district. The estimated annual demand for Cincinnati fertilizer plants is about 60,000 tons.

Considerable quantities of all sorts of fats and oils are used in the Southern Ohio chemical industries,—notably in soap making. The animal fats are in the main available from local packing houses and reduction plants.

Excepting iron, there is no smelting carried on in the district. In 1924 Southern Ohio furnaces produced about 1,700,000 tons of pig. Metallic lead, zinc, and copper are shipped from outside smelters and find use in Southern Ohio in such products as alloys and finished parts (e.g. valves and bearings), and in the making of pigments.

Consumption of raw materials and heavy chemicals:

Estimated Monthly Consumption of Heavy Chemicals in Southern Ohio

	Tons
Sulphuric acid, all strengths	10,000
Phosphate rock	6,000
Salt	2,000
Chlorine (free or chlorine freeing)	900
Chile saltpeter	650
Hydrochloric acid	250
Caustic soda	225
Ammonia (mostly as sulphate)	65

The sulphuric acid consumption by industries follows:

Estimated Monthly Consumption of Sulphuric Acid, Southern Ohio District

Use	Tons
Steel pickling	5,000
Fertilizer manufacture	3,000
Soap-making	1,000
Miscellaneous (dyes, batteries, esters, etc.)	1,000
	10,000

The larger part of this acid (86 per cent) is used as 60 deg. Bé. acid; 66 deg. Bé. acid is consumed to the extent of 13 per cent, while 33 deg. Bé., 26 per cent free SO_3 and 70 per cent free SO_3 acids total 1 per cent. Most of the acid comes from scattered plants in Ohio or from Ducktown, Tennessee. A smaller quantity is made in northern Illinois. The presence of a moderate-sized chamber plant in Cincinnati has already been noted; besides this, the nearest works are at Indianapolis, Columbus (Ohio), and Nitro (West Virginia). A plant is under construction at Greenup.

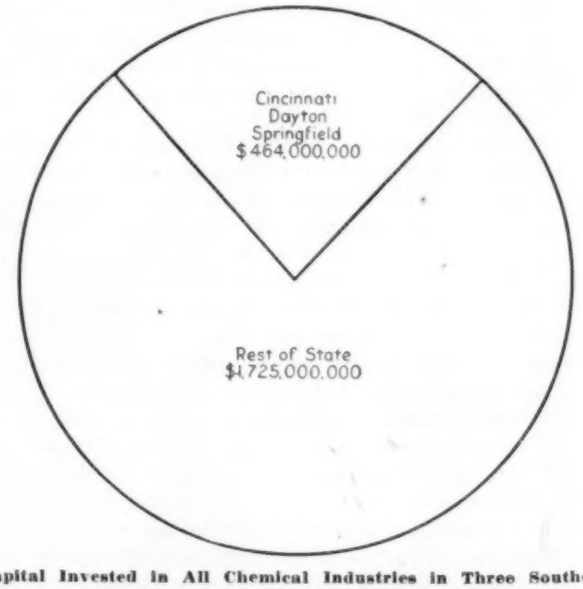
Caustic soda is demanded mainly by soap factories and paper mills. Considerable sulphite is utilized in the paper mills of the Miami Valley, and white pigments and sizing are also shipped in large quantities, but estimates for these chemicals are not readily made.

The total salt consumed in the southwestern quarter of the state probably amounts to 25,000 tons per year. About 40 per cent of this goes to soap-making establishments. The exact sources throughout the district are not known, but data obtained indicate approximately the following for the sources of the raw salt (rock, grainer, or otherwise) used in Cincinnati.

Sources of Raw Salt for Cincinnati Industries

Source	Chief Uses	Estimated Monthly Consumption, Tons
Michigan	Soap, ice cream	610
Louisiana	Ice cream, chemicals	470
Southeast Ohio	Soap	370
Northeast Ohio		10
Total		1,460

Data on consumption of the metals are not as readily available as data on chemicals. Estimates for pig iron in the southeastern area are not at hand, but in the southwestern district the purchases probably are 200,000 tons in a normal year (not including the consumption of the rolling mills at Middletown). Of this amount approximately a quarter is used by foundries.



Capital Invested in All Chemical Industries in Three Southern Ohio Cities and in the Entire State of Ohio

Southern Ohio is well supplied with electric power. Within the district are three large generating stations. The Union Gas & Electric Co has a plant in Cincinnati with a rated capacity of 125,000 kva.; this yield finds its outlet largely in supplying local industries. To Cincinnati and Miami Valley towns is linked the Miami Fort Station, very well equipped and having a rated capacity of 95,000 kva., but laid out so as to permit rapid expansion to about three times the present capacity as the demand rises. These two plants are connected with the Millers Ford Station at Dayton, Ohio, which has a capacity of 106,000 kva.

In Eastern Ohio the Ohio Power Co. has a generating station at Philo, near Zanesville, which is linked to the company's Windsor plant on the West Virginia side of the river.

At Louisville, Kentucky, the Kentucky Utilities Co. generates 85,000 kva. The Dix River plant in northwestern Kentucky is about 100 miles from the Ohio State boundary and can furnish 30,000 hp.

Most of these stations are steam-generating; the hydro-electric possibilities of the region as a whole have not been intensively exploited.

The southeastern section of Ohio is served by coal fields surrounding Jackson and Ironton. For ordinary fuel purposes these coals are acceptable, but for coking the coals of eastern Kentucky, which are almost equally near at hand, are preferred. The Kenova-Thacker and Ashland fields lie along the Ohio or its tributaries, so that they are accessible for water shipment. In this connection, attention is called to the rapid rise of Kentucky as a coal producing state, from sixth in rank in 1910 to fourth in 1924,—a gain due to an increase of 221 per cent in production, whereas West Virginia, the other rapidly rising coal state, only increased its production 80 per cent during the same period. The nearness and high quality of these coals, the ready access of most of them by rail and of some by water, and the presence of suitable plant sites on the river offering unloading economies, combine to make the fuel situation favorable for those industries where self-generated power or great heat consumption represent large portions of the running expense.

An additional source of fuel and power is offered by the natural gas of West Virginia and eastern Kentucky. The important fields are connected with Southern Ohio, northern Kentucky, and southern Indiana by several pipe lines. One of the mains runs through Catlettsburg and Maysville, Kentucky, to Cincinnati; the other leads west from Marietta, in a direct route through Sugar Grove, toward Muncie, Indiana. Instead of drawing upon the natural gas lines, several firms make their own producer gas.

On the other hand, oil pipe lines are relatively few in the Southern Ohio region. There are distributing lines which enter the state at the east-central border, but none are in the southwestern area. From this one would expect—and correctly—that coal is generally preferred to fuel oil, and, further, that there are no large refineries in the southern part of Ohio.

The labor situation in Ohio is too varied to admit of much generalizing. In the southeastern part of the state the population is rural and the cities maintain a class of relatively unskilled labor,—chiefly coal miners and metal workers. For employment in blast furnaces and steel mills such a population is preferable to that of the more northerly centers because it is less itinerant. In some industries, such as textile mills, where relatively inexpensive labor, not highly trained, is indeed, a location in northern Kentucky along the Louisville and Nashville or Southern Railroads might prove desirable.

In the more industrialized parts of southwestern Ohio the standard of living is higher, workmen are more skilled, and labor costs are greater. For chemical industries this is a distinct boon. There is a strong German cast to such cities as Dayton, Hamilton, Springfield, and Cincinnati; insofar as generalizations are trustworthy, these communities are favored with men having frugal habits, coupled with the capacity for careful workmanship and with high standards,—a class of skilled craftsmen, rather than of day laborers. The population is settled and there is generally no dearth of men capable of taking up work where intelligence is a prime requisite.

Transportation facilities in Southern Ohio are good. The district is served by seven major railroad lines. The Detroit, Toledo, & Ironton and the Hocking Valley connect the coal districts and northward consumers.

There has been some consideration of the construction of a canal joining Lake Erie with the Ohio River. Such a project would obviously aid in shipments to and from those Southern Ohio cities that lie along the route selected.

Unquestionably the greatest possibilities for transport expansion are in the direction of river traffic. By 1929 the Ohio River from Pittsburgh to the Gulf is to be made navigable. This plan, begun several years ago, is already bearing fruit, as is shown by the following table prepared by the Ohio Valley Improvement Association.

Tonnage Shipped on the Ohio River

Year	Iron and Steel	Oil
1912	9,755	24,460
1914	38,563	3,614
1916	6,496	5,596
1918	22,456	20,750
1920	355,331	46,412
1922	316,239	30,632
1924	557,650	73,420

There is an undeniable saving in freight through river transport, especially if large shipments are made. This is balanced against the time gained by rail.

That the importance of the Ohio River route is fully recognized is demonstrated by the energy with which such cities as Louisville and Cincinnati are developing river-rail terminal facilities.

A favorable factor, in a general sense, is the location of the Southern Ohio district near the line separating the grain-growing or industrialized northern states and the southland with its vegetable oils.

The feature that characterizes the industries in southern Ohio is the variety represented. The products extend from such things as pig-iron—virtually a raw material—to machine tools in the metallurgical field, or, to consider chemical materials, from crude salt, coal, and skins to drugs, dyes, and tanned hides. The outstanding chemical industries are paper mills, soap factories, and tanneries; most prominent among metallurgical plants are blast furnaces and ferrous and nonferrous foundries. The absence of oil refineries is noticeable.

In the future this district may be expected to expand in the direction of having its own coke ovens in the southwestern area and of developing more basic industries to serve as feeders for the fine chemical producers and the fabricating trades.

Resources and Labor of NEW YORK *Underlie Strong Industrial Developments*

By William M. Booth
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THE VALUE of any locality commercially lies primarily in the presence and use of raw materials. These may be found in the forest, in the earth, in fisheries, or in arable lands. A strategic commercial location such as a fine natural harbor, waterpower, or unusual and satisfactory climate may favor a locality in addition to these natural resources or even in their absence.

The first and greatest natural asset of New York State is and has always been a vast territory of tillable land well and seasonably watered, subject to an equable climate with a definite crop growing period. Earthquakes, cyclones, wash-outs, tornadoes, and hurricanes are unusual and when these do occur, they are confined to limited areas.

The second asset is a remarkable lake and river system with drainage areas so elevated as to make the production of water power general. Under this subdivision we include the economic value of Niagara Falls and the St. Lawrence River.

The third asset is the possession of the lowest pass over the Appalachian Mountains, east and west, about 400 ft. at Rome, N. Y., thus connecting the Great Lakes system with the Atlantic Ocean through the Mohawk and Hudson valleys.

The fourth great asset of the State is the port of New York, an all-year-round harbor connecting the whole interior of North America with the Atlantic seaboard and the great cities of the World. Commerce has developed in such a manner that the interests of the entire state are daily placed in greater dependence upon this resource.

The fifth great asset of the state was its forest, ruthlessly destroyed in a few generations. We now stand astonished and helpless as the great paper mill industries find other locations further north near a raw material supply.

Minerals constitute our sixth asset. We possess no merchantable coal,—our fuel reserve is small and consists of petroleum in the southwest portion of the state and natural gas lightly distributed throughout western New York. Our iron ore deposits are widely distributed but do not compare in quantity or thickness of deposit with those of Minnesota, Pennsylvania, and Alabama. We possess no gold or silver ores of marketable value.

Although handicapped in respect to raw materials now in demand, New York may possess vast stores of some earth or element that can be recovered electrically by means of our water power. Fortunes are now being made in the manufacture of chemicals in the state. Although many of our young men have graduated as chemists and engineers, they cannot found huge industries without financial assistance. Capitalists and bankers do this. The latter usually lend their support to projects that are pretty sure to return a fine income. Our mineral resources produced a return of about $100,000,000 during the year 1926. We will take up the subdivisions in the order of their importance.

The homes, stores, and public buildings of the early Dutch settlers were constructed from Holland brick. Clay was later found throughout New York in great abundance. For many years it has been used in the manufacture of stoneware, tiles, and of special and common brick. Blue and red clays and shale rock are the raw materials employed. With few exceptions, this industry clings to antiquated methods. There is real need for a more thorough study of the processes employed. Last year the returns from the brick industry amounted to $25,000,000. Fire brick is not produced as there is no fire clay. The best pottery clays are imported from abroad; some are shipped from North Carolina and Alabama.

Gypsum was discovered at Camillus near Syracuse in 1792. In 1808 a company was formed to distribute it as fertilizer or land plaster. This business languished but the cement and plasterboard demands are already great and increase annually. Of a raw material supply, New York may be said to possess sufficient for generations. The deposit extends from Madison County westward 150 miles. At Fayetteville the bed is 30 feet in thickness. The gypsum area extends north and south from 10 to 20 miles and has a thickness of from 4 to 10 ft.

The uses of this mineral have been expanded so it is now a competitor of lime in building operations. Enormous plants have been erected northwest of Batavia. Output in 1926 was one million tons valued at $14,000,000. The manufacture of sulphuric acid from gypsum seems worthy of careful investigation particularly as an electric furnace operation.

THE opening of the Erie Canal in 1825 led to the discovery of a natural hydraulic cement termed "water lime." This was burned and sold from the Syracuse district for more than a century. For many years Rosendale cement was produced in enormous quantities adjacent to the City of Kingston. The annual output reached 4,000,000 bbl. per year. As early as 1881 a portland cement plant was built and operated near Beacon on the east bank of the Hudson River. In 1886, Thomas Millen began the manufacture of portland cement at Warners just west of Syracuse. The raw materials of this plant were clay and marl. Rotary kilns were later installed here. Clay and marl plants were also built west of Syracuse at Jordan, Montezuma, Wayland, and Caledonia. The principle of the process was wrong from the beginning, as marl tenaciously holds about its own weight of water. The mixture of clay and marl was necessarily made in the wet state. The kiln process required the evaporation of this enormous excess of water. The limestone-shale mixture proved to be a competitor that has completely replaced the marl-clay process. Portland cement manufacture has attained large proportions in the Hudson Valley. Plants have been built at Glens Falls and at Howe's Cave. Central New York is represented by the Alpha Portland Cement plant at Jamesville and the Cayuga Lake Portland Cement Co., north of Ithaca. The output of the cement industries of New York State in 1926 totalled seven million barrels valued at $14,000,000. This is a business that demands the closest chemical control. The low price at which the product is sold favors production near the market.

The petroleum district of New York comprises parts of the counties of Cattaraugus, Allegheny, and Steuben in the southwest. This is the northern limit of the Pennsylvania oil fields. The territory was opened in 1875-6. The oil is of the best quality, but the yield per well is low. The return for 1926 from petroleum and natural gas was $8,000,000.

In 1789 a heavy import tax was levied upon salt. For many years the solar evaporation of sea water had been carried on upon the shores of Cape Cod and Long Island. The saline brines of Onondaga Lake now came into prominence as the basis of the great salt industry of Syracuse. Wells were sunk near the lake shore and the brine was pumped through log conduits.

As early as 1821 solar evaporation was begun and two expert engineers were brought from Cape Cod to build and operate the vats. By 1825 the Erie Canal had been finished from the Hudson Valley to the Niagara River. Salt was then shipped to the Mississippi and Ohio River Valleys, eastward and southward. This business reached its climax soon after the close of the Civil War when other deposits were developed in the western part of New York State and in localities westward.

In 1878, rock salt was discovered at Wyoming Village. Here a layer 70 ft. in thickness was found. In 1881 the Solvay Process Co. of Syracuse was incorporated, a branch of the Belgian company operating under the patents of Solvay Brothers. The purpose of this organization was the manufacture of soda products. Salt, limestone and coal were required as the raw materials. The weak brines of the salt wells at Geddes were strengthened by adding boiled salt to the vats through which the brine was conducted. By 1884 the alkali business at Solvay had become well established.

In 1888 rock salt was discovered in great beds from 200 to 300 ft. in thickness north of Tully, N. Y. Operations have been extended from time to time until more than forty wells have been placed in service. Water is pumped to the rock salt and saturated brine is obtained. This is pumped to the surface where it flows by gravity to a reservoir at the Solvay plant. Limestone was formerly obtained at Split Rock three and one-half miles away. The present quarries are located at Jamesville about eight miles distant.

In 1885 a well was sunk at Ithaca and 248 ft. of rock salt were penetrated. Works have been established upon Cayuga Lake, at Watkins, and rock salt mines are worked at various places in Wyoming County. Salt is decidedly the most useful natural chemical product of the state. It is the basis of a number of operations at Niagara Falls.

As is the case with gypsum or limestone, our deposits of salt are so great and are so easily worked that monopoly of ownership or control is impossible. The salt area of New York State may include as much as 2,000 square miles. Salt beds have been found east and southeast of Syracuse by deep well drilling.

These is an abundance of limestone of the best varieties well distributed throughout the state. The Trenton stone encircles the Adirondacke like a horseshoe extending from Glens Falls through Trenton Falls to Watertown. The calcium carbonate content of samples from many localities has been proved to be well above 90 per cent. Limestone of excellent quality is found in Onondaga and Cayuga Counties and westward.

The manufacture of building lime was formerly carried on very extensively in hundreds of isolated localities throughout the state. The business was not controlled chemically. Lime thus produced sometimes contained silica; it was occasionally overburned; it might contain magnesium or clay. Practically all of the building lime used in New York state is now imported. Limestone is crushed at a great many plants and the product is used in the construction of roads.



Fig. 1—Salt District of New York State, Showing Location of Mines, Wells and Borings

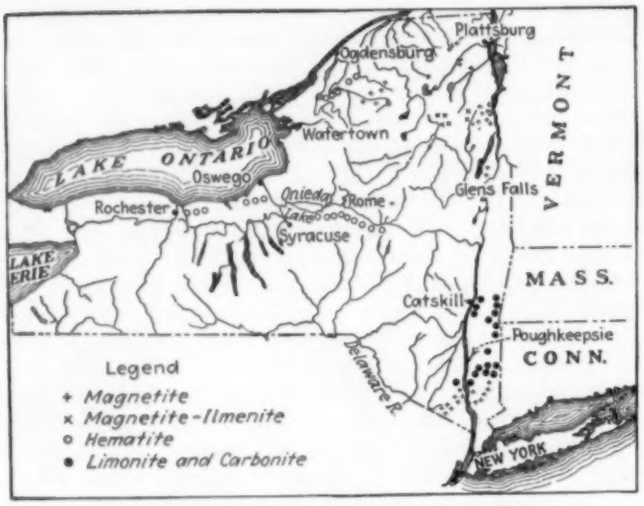


Fig. 2—Iron Ore Deposits of New York State

This process produces immense quantities of byproduct limestone dust. All of this should be used by farmers, but they seldom avail themselves of so good a fertilizer.

The manufacture of iron in the American colonies was prohibited by the English Parliament in 1750. As early as 1751, the Sterling furnace in Orange County was producing this metal. Bloomeries were located upon many small streams of Central New York. Blast furnaces followed along the outcrop of the red oxide hematite ore at Clinton, Kirkland, Lenox, and westward to Charlotte. Pig iron of fair quality was produced and used in merchant mills in Rome and Auburn. A large industry was developed north of Albany. With the disappearance of charcoal, anthracite coal was brought from Pennsylvania. Economically this proved impracticable and the business gradually drifted to the sources of the fuel. The state is still a large shipper of iron ore and the most noteble plant in the state for the mining and treatment of magnetite ore is that of Witherbee-Sherman & Co. at Mineville. Hematite ore is shipped from Clinton and also until recently at least, from the Rochester district. At Clinton, New York, is located the Clinton Metallic Paint Co. plant. There iron ore is ground to a fine powder and prepared for paint. Some of the product is roasted and mixed with earths from other sources.

When the Minnesota ore supply fails we have in New York an immense bed of Clinton hematite, outcropping between Herkimer and the Niagara River. This is estimated to contain 600,000,000 tons of ore. The phosphorus content of Clinton ore is low and the sulphur is successfully handled in Pennsylvania furnaces. It is possible that electrically smelted iron can be produced from magnetic iron ore in northern New York. Returns from the sale of iron ore in 1926 amounted to $1,500,000.

Included as a part of the mineral wealth of the state are large beds of dolomite. The best of this should be utilized for the production of magnesium salts although the writer does not know of any operation of this kind in the state.

Graphite is distributed over a territory extending from Essex County to Saratoga Springs. It is usually mined. The operations are carried on through the use of the most modern machinery. The quality of the output is excellent.

Garnet is found at Thirteenth Lake, upon Gore Mountain, and at Wevertown, both in Warren County. It is used as an abrasive, being hard, durable and tough.

Pyrites, a useful mineral, is found in commercial quantities in St. Lawrence and Jefferson counties. Some samples compare favorably with the Spanish product, although the deposits are usually considered of low sulphur content. The entire pyrites district should be made the subject of study with an idea of using this mineral for some chemical operation.

Excellent talc is found in St. Lawrence county. This is a hydrated magnesium silicate. It is used extensively as a filler in many industries. The rock is mined, then crushed, ground, and bolted; and is sold in several grades. New York state talc could be used in many operations where the imported article is thought absolutely necessary. A large use is as a paper filler and the rubber consumption is large. This mineral may be made the basis of a number of chemical operations. The output in 1926 amounted to $1,000,000.

Recently a zinc ore industry is being built up in New York state. The localities where zinc ore is found in paying quantities are St. Lawrence, Sullivan, and Essex counties. The 1926 business amounted to $600,000.

Feldspar occurs in the Adirondacks and southwestern highlands. It has many uses: potters manufacture glazes and enamels from it; it is employed as a binder in abrasive wheels; it is added to cement mixtures; and is used in scouring compounds. As a source of potash, these deposits demand the closest study and extensive exploration.

The importance of an abundance of pure water can hardly be estimated. This territory is one of the most favored of any in the United States in this respect. Upon the average, it is probably safe to say that a cubic yard of rain water is precipitated upon every square yard of soil annually throughout the state. Of this, a run-off of 1 cu.ft. per second per square mile may be conserved in our watersheds. The Hudson is a tide water river—Lake Ontario has an altitude of 247 feet above sea level and is 326 feet lower than Lake Erie. The volume of water passing the Falls is about 280,000 cu.ft. per second. A simple computation shows 4,500,000 hp. available through the fall of this water. The altitude of the Appalachian Mountain foot hills is sufficient to produce several million horse power besides that of Niagara Falls.

THE position of the Trenton Limestone encircling the Adirondacks and carrying immense volumes of calcium carbonate (above 90 per cent) makes some combination of these—water power and limestone or of the limestone and the beds of high grade silica sand and gypsum seem a possible source of income. The manufacture of calcium carbide has been considered. Heavy chemicals suffer in transportation costs but the products made will necessarily find a ready market east and west. The main objection to the use of electric power upon a large scale in the manufacture of chemicals in the Albany, Watertown, and Buffalo districts is the price at which this may be sold for miscellaneous manufacturing. This applies to the Buffalo district as well. The decadence of the paper mill industry of northern New York is releasing power for other purposes. It may be said that approximate prices for large blocks of power in the central district range between one and one-half cents per kw.-hr. to small manufacturers, ten hour service; one cent per kw.-hr. for twenty-four hour service, somewhat less for steel manu-

facture. We believe the separation of hydrogen gas from water and its distribution through pipes as an outlet for "off-peak" power in remote locations might be considered.

The waters of the Adirondacks are ideal for manufacturing purposes. They represent the run-off from granitic areas. The river waters throughout the state are moderately hard. Wells between Albany and Buffalo are generally unsatisfactory for any purpose excepting for cooling. These waters contain lime bicarbonate, gypsum, salt and some magnesium. Had it not been for the routing of the Erie Canal through Syracuse, the southern shore of Lake Ontario and Oneida might have been the populous manufacturing area between Rochester and Utica. Vexatious water situations would have been dismissed at an early date. The water of both lakes is wholly satisfactory for general chemical or manufacturing use. The waste disposal problem, with a lake the size of Ontario would have been a simple matter. Such developments may now be impossible due to the use of Lake Ontario water at Rochester and at Oswego for city supplies. A ridge of high land runs through the state from east to west dividing the waters of the north and Finger Lakes district from those of the southern tier of towns represented by Cortland, Binghamton, Elmira, and Corning. The inroads of the City of New York upon the watersheds supplying the streams upon the west bank of the Hudson River to Kingston and upon the opposite side of the river to Fishkill make large manufacturing operations questionable in these areas unless the water of the Hudson is employed. This is a navigable stream, subject to government restrictions, found in some cases to be very exacting.

THE PRICES paid by manufacturers in the cities of New York have steadily attracted both men and women from the farms and smaller towns. The state includes also a large foreign population of Italians, Poles, Ukranians, Russians, and others of foreign birth or descent. The labor situation in the state is and has been wholly satisfactory from the manufacturing standpoint. Common trade or technically skilled men and women are available for fair wages. They may easily be classed the best paid and among the most useful of any workmen and workwomen to be found in the United States.

New York state presents a stable, efficient, and dependable labor situation. The common labor rapidly adjusts itself to unusual technical demands. Between the manufacturers and the State Department of Labor exists a satisfactory relation. Hours of service, protection from dangerous machines, and poisonous fumes or gases, comfortable work rooms and an adequate lunch hour have been worked out and are maintained with great care and attention through an inspection service. In many plants all employees are insured in addition to accident insurance which is obligatory to all who employ labor in the mills.

Miscellaneous industries in Buffalo, Rochester, Syracuse, Utica, and Schenectady maintain the proper balance of male and female labor. Experience with hundreds of Polish men and women, Italians, native Americans, Germans, Dutch, and Englishmen has been that they are all anxious to return a day's work for a day's wage. Lack of skill is the main difficulty with foreign labor.

The railway system is very complete. This includes steam and electric lines. These connect all of the commercial towns of the state. They are supplemented by motor buses reaching practically every town of commercial importance.

The Barge Canal is being developed for both Buffalo and New York City business. The Munson Steamship Line operates a barge service to Syracuse. Sand, gravel, crushed stone, crude and refined oils, grain, and heavy freight are regularly carried during the season.

THE PORT of New York—already in touch with all of the great shipping centers of the world—is being much improved with enlarged docks and deepened channels. The Hudson River passenger and freight service between Troy, Albany, and New York, places the manufacturer of this district in a favorable location for New York City business between May and November when the ice is out of the river.

Freight boats connect the cities of Lake Ontario and the St. Lawrence with Montreal. New York City is the only open water port during the winter months. Those of Buffalo, Rochester, Oswego, and Ogdensburg are closed from November to May depending upon the season. We may conclude by saying that the railway service of New York state both for passenger and freight is unsurpassed anywhere. Practically all of our large manufacturing operations include a traffic department. This type of service has proved invaluable to its principals. The most direct routing is obtained for raw materials and finished goods. The whole service of collection and distribution is simplified.

Goods must be sold or the whole process of collecting raw materials and elaborating them to a finished product is a useless performance. The ideal location for the plant is the geographic center of the market for its products. For an article used generally by our people the strategic location would coincide with the center of population. This plan favors Cincinnati, Louisville, Dayton, Ohio, Indianapolis, and St. Louis. However, transportation, we will say, of heavy chemicals from one of these cities westward 500 miles is accompanied by a great distribution cost. Perhaps coast line steamships could carry these from New York and lay them down in New Orleans or Houston cheaper than they could be made and shipped from the western location. Again the New York area, although far east of the strategic center, has immense advantage due to a concentrated buying population.

The Boston-New York-Philadelphia district includes many millions of people within twelve hours distance by train and with over night freight service. Chemicals are usually purchased by manufacturers in connection with the operations of the plant. Nowhere is there a more concentrated manufacturing area than within the Boston-New York-Philadelphia triangle. The demand is constant and the total volume consumed enormous. This applies to crude acids, laundry chemicals, cleaning compounds, caustic soda and soda ash. The plating industry alone requires thousands of tons of salts annually. In addition to this concentrated and active Boston-New York and Philadelphia market, is the chemical export trade from these cities to the South, to the West Indies, and to South America. This is a huge business and is growing.

New York state, anywhere on the line of a through railway system, can well support a chemical plant manufacturing something that sells readily in the New York City or export market.

On the Engineer's Book Shelf

The Industrial Utility of Coal

PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON BITUMINOUS COAL. New Developments in Utilization. Carnegie Institute of Technology, Pittsburgh. 830 pp. Price $7.

The first International Conference on Bituminous Coal, held at the Carnegie Institute of Technology, Pittsburgh, Pa., November 15 to 18, 1926, was reported at length in *Chem. & Met.* The present volume contains the complete papers and discussion given at the conference, illustrated; the list of official delegates; and a large map, in color, showing the coal resources of the United States.

The papers at this conference gave a comprehensive picture of the researches and developments at present under way on bituminous coal, with a fairly complete picture of present utilization practice. Altogether these papers represent the most complete picture of the industrial utility of coal that is at present available. No worker in the field of coal processing or treatment can afford not to own and use this volume.

Chemistry of the Oil Industries

CHEMISTRY OF THE OIL INDUSTRIES. Second Edition, Revised and Enlarged. By *J. E. Southcombe*. D. Van Nostrand Company, New York. 224 pp. Price $4.

Reviewed by Brian Mead

This book is apparently one of a series on the technology of various industries of the British Empire, and it is an earnest attempt to introduce the chemistry of "the oil industries." Unfortunately, no sharper distinction is made, as the technology of the mineral and vegetable oils do not have much in common. Moreover, confusion is caused throughout the text since the word "oil" is used indiscriminately. Another source of confusion comes from the haphazard use of both the Centigrade and Fahrenheit temperature scales. The value of the book would be increased greatly by literature references. The account of mineral oil refining is at best elementary and sketchy.

As an introductory text for the classroom, the book may have some value, especially as an attempt is made to introduce the colloidal point of view. To the technologist it will have very little value.

Chemical Metamorphosis and Piezochemistry

PHYSICO-CHEMICAL METAMORPHOSIS AND PROBLEMS IN PIEZOCHEMISTRY. By Ernst Cohen. McGraw-Hill Book Company, Inc., New York. 190 pp. Price $2.50.

Reviewed by E. D. Ries

Those of us who were fortunate enough to hear Professor Cohen during his recent tour of the United States remember the clear manner in which he presented his talks. Whether they took up questions of pedagogy, biography, or science, they were in all cases interesting. Cornell was particularly fortunate in having him there for a relatively long period; and the publication of his lectures makes his ideas available to all.

The title suggests that he has taken up two separate subjects in his lectures. The reviewer feels, however, that a third topic should be included, since his introductory lecture on teaching methods should be read by everyone at all concerned with curricula.

The two major divisions of the book take up important work in fields which have too long been neglected. Cohen emphasizes the importance of "physical purity" as well as chemical and points out that much of our fundamental data on heat effects, etc., are open to question due to the presence of more than one physical modification in chemically pure substances. This idea is of course familiar to the theoretical chemist, but Cohen points out that the presence of modifications is frequently not suspected.

Little need be said about the value of piezo- or pressure chemistry. The influence of temperature as a variable has been carefully studied, but probably for mechanical reasons more than any other, the influence of pressure has been rather neglected. Cohen gives a critical review of the methods available for chemical studies under high pressure and also new methods and data of his own. The reviewer hopes, however, that Cohen will enlarge his field of work in the future to include experiments on the piezo-electric effect.

The book is very easy to read and much can be gained from it by even a superficial study.

Aluminum and Its Alloys

ALUMINUM, THE METAL AND ITS ALLOYS. By *M. G. Corson*. D. Van Nostrand Company, New York, 291 pp. Price $8.

Reviewed by Robert S. Williams

Part I gives the properties of pure aluminum largely in the form of curves and tables. *Part II* is a systematic description of a series of alloys including forty-four binary systems, four ternary systems and a list of important ternary systems not yet investigated. This section of the book includes diagrams and in many cases curves showing the usual mechanical properties. *Part III* deals with the technology of aluminum alloys showing largely in the form of tables the composition and properties of the (1) casting and (2) the forging alloys. The properties of the usual commercial alloys are discussed with special reference to the theoretical aspects of the industrial problem with statements as to the reasons for various additions. This section includes many thought-provoking suggestions as to future lines of investigation. *Part IV* deals with the problems of corrosion both fundamentally with respect to the causes and in detail with regard to the corrosion of particular alloys. *Part V* treating of the aluminum alloys in engineering is perhaps the most interesting section of the book as it deals with the applications of aluminum alloys in engineering practice, not so much in the formal statement of their commercial uses as in an attempt to make such a classification of them that the reasons for the selection for

specific purposes are evident and the reader can get a picture of the advantages and disadvantages of each class. For *Part VI* the author has coined the word "Structurography" to include not merely the usual micrographic examination of the metal and its alloys but to study as well the effects on properties of the mechanism of crystallization, dendrite formation, grain orientation and the like.

The technique of structurographic examination, polishing, etching, etc., is described and the results are shown in a series of excellent macro- and micrographs comprising a series of plates, 117 in number, in the back of the book.

The reviewer is impressed with the logical form in which the material is presented and with the generous use of charts and tables in correlating the data given. The author has not assumed that because an operation is standard practice it is not open to question, and the book is filled with suggestions as to the reasons for certain characteristic properties of the alloys and contains many ideas as to future lines of study and development. The book is a valuable contribution to the literature of these increasingly important alloys and will be of interest to every serious worker in the field. It is clearly printed, and the photomicrographic reproductions are excellent. The author's subtitle, "A Critical Descriptive Treatise," is clearly justified.

Treatise on Thermodynamics

TREATISE ON THERMODYNAMICS. By *Max Planck*. Third English Edition Translated from the Seventh German Edition by *Alexander Ogg*. Longmans, Green and Co., Ltd., London. 297 pp. Price $5.

Reviewed by E. D. Ries

There are only two changes of importance in this edition as compared to previous editions. The first is a specific one and consists in the addition of about four pages on the theory of the lowering of the freezing point of strong electrolytes as developed by J. C. Ghosh. The other change is the addition of a chapter on "Absolute Value of the Entropy" taking up Nernst's Theorem. This constitutes a valuable addition, as it emphasizes the possibilities of the "Third Law of Thermodynamics."

One of the commonest complaints among scientific men is the inadequate indexing of foreign books. The reviewer feels that this book is no exception. A somewhat more complete index would be helpful. There are several typographical errors still to be found; in view of the mathematical nature of the material, however, they are remarkably few in number.

Quantitative Analysis

QUANTITATIVE ANALYSIS. By *Stephen Popoff*, assistant professor and head of analytical chemistry, State University of Iowa. P. Blakiston's Son & Co., Philadelphia. 559 pp. Price $4.

In this second edition, Professor Popoff has retained his original plan of combining theory and practice in the teaching of quantitative analytical chemistry. The changes from the first edition include the recasting of several chapters; the modernization of the theoretical discussion; the addition of chapters on valence, colloids, oxidation-reduction reactions, electro-analysis, reactions from the quantitative side, conductimetric titrations, colorimetric methods, nitrogen and iron and steel analysis; a simplification of the methods of calculation; discussion on errors and rules of computations; and the inclusion of three sets of atomic weights: one for weights in vacuo, another for weights in air, and one for calculations within an error of 0.1 per cent.

A Text-Book of Inorganic Chemistry

A TEXT-BOOK OF INORGANIC CHEMISTRY. By *Fritz Ephraim*, professor of chemistry in the University of Berne. English Edition translated by *P. S. L. Thorne*, lecturer in chemistry, Sir John Cass Technical Institute, London. Gurney & Jackson, London. 805 pp. Price 28s.

Advanced students and practititioners of chemistry will find in Professor Ephraim's book an orderly presentation of the numerous facts of inorganic chemistry. The book is up to date, as it is a translation from the Third German Edition with additions by the author; it is self-sufficient for most reference purposes as it treats each subject in much more detail than the usual text-book; and finally it is easy to consult. Although an acquaintance with elementary chemistry is a prerequisite, yet the reader with general engineering training will find the book extremely usable.

Employment Statistics for the United States

EMPLOYMENT STATISTICS FOR THE UNITED STATES. Edited by *Ralph G. Hurlin*, director department of statistics, Russell Sage Foundation and *William A. Berridge*, associate professor of economics, Brown University. Russell Sage Foundation, New York. 215 pp. Price $2.50.

This book outlines recommendations for the national collection of employment statistics and for the uses of such data. It is the consensus of opinion of the following Governmental Committee on labor statistics: Charles E. Baldwin, Eugene B. Patton, A. J. Altmeyer, R. D. Cahn, Roswell F. Phelps, J. Frederic Dewhurst and Joseph A. Becker. Methods are described for the collection of payroll statistics, tabulation of payroll statistics, construction of an index of employment or earnings, publication of the results of the monthly survey and the procedure used in a representative bureau.

The Law of Chemical Patents

THE LAW OF CHEMICAL PATENTS. By *Edward Thomas*. D. Van Nostrand Company, New York. 420 pp. Price $6.

Reviewed by H. A. Toulmin, Jr.

The book consists of a series of disjointed, partial quotations from digested cases, arranged one after the other, and so deleted and fragmentary as to scarcely make them understandable. The omissions from the quotations alone raise the question of the accuracy of the quotation, necessitating a reference to the original volumes of the decisions from which the quotations are made.

Again, the book is merely a digest consisting almost solely of these quotations. No conclusions of the author, no statements of the law based upon these quotations, no analysis of the law for the benefit of the reader and no deductions based upon the author's experience and knowledge are found in the book.

It fails as a digest because the quotations are so fragmentary as to be inaccurate; it fails as a treatise because the author has contributed nothing except the labor of collecting the fragments; it adds nothing to the literature on the subject. All of its subject matter can be easily and fully arrived at through the established digests which are ample for the purpose.

Readers' Views and Comments

An Open Forum

The editors invite discussion of articles and editorials or other topics of interest

Electrolytic Hydrogen and Cheap Fixed Nitrogen

To the Editor of Chem & Met.:

Sir—It has long been recognized that oxygen is the problem, if we are to have cheap hydrogen for ammonia synthesis. It also has been pointed out that cheap oxygen opens up a new field in metallurgy and chemistry, and I have before me much data, all of which indicates that when reasonably pure oxygen can be had at $18 per ton and less, the gas becomes more and more usable as the price lowers.

I shall demonstrate that with a.c. power at $20 per hp.-yr. the gases hydrogen and oxygen will cost 35c. per 1,000 cu.ft. which is about $7.85 per ton for the oxygen. At $15 per hp.yr. the cost is 28c. per 1,000 cu.ft. equivalent to $6.28 per ton of oxygen. At $10 per hp.-yr. the cost is 20c. per 1,000 cu.ft. or $4.48 per ton for the oxygen. It is to be understood that the foregoing is based upon an equal value for both gases.

To manufacture 144,000 annual tons of ammonium sulphate-nitrate containing 40,000 tons of nitrogen, the following plant will be required:

Electrolytic	plant	$2,175,000
Synthetic ammonia	"	4,325,000
Sulphuric acid	"	1,750,000
Ammonium sulphate	"	750,000
Nitric acid	"	1,750,000
Ammonium nitrate	"	750,000
Ammonium sulphate-nitrate	"	500,000
Total plant capital	.....	$12,000,000

To meet the requirements of the fertilizer trade where payments are deferred, we will provide a working capital of $6,000,000.

Fixed charges at 12 per cent on capital will be apportioned to each branch of manufacture and 10 per cent on the entire capital of $18,000,000 will be taken to cover sales expense, administration, miscellaneous expense and profit.

Plant	$12,000,000 @ 12 per cent...	$1,440,000
Working capital	6,000,000	
Total capital	$18,000,000 @ 10 per cent...	1,800,000
Total overhead		$3,240,000
Per ton of contained nitrogen		$ 81.00
Per lb. of contained nitrogen		4.05c.

Electrolytic Plant.—Motor generators at 90 per cent conversion efficiency are the basis of my costs, although we may have converters at 93 per cent efficiency or

Gas cost is 35c. per 1,000 cu.ft.
Cost of hydrogen is $124.60 per ton or 6.23c. per lb.
Cost of oxygen is $7.84 per ton or 0.39c. per lb.

mercury-arc rectifiers at 97 per cent efficiency. Electrolytic cells at 12,000 amperes and 1.9 volts are obtainable and are the basis of my estimate. The power requirements are 88,000 hp., a.c. for the generation of the gases and 12,000 hp. for the nitrogen fixation plant, and is taken at $20 per hp.-yr. The manufacturing cost including 12 per cent on plant cost is $2,071,000 per year.

Synthetic Ammonia Plant.—This is a modified Haber medium-pressure plant using 25-ton units. With power at $20 per hp.-yr. nitrogen by the liquid air process will cost at least 18c. per 1,000 cu.ft., and as two volumes of nitrogen can be obtained from one volume of hydrogen we will make use of comparatively inexpensive apparatus to produce our nitrogen-hydrogen mixture by burning the oxygen out of air with hydrogen and condensing out the water vapor. The manufacturing cost including 12 per cent on plant capital, is $2,268,000 for the production of 48,570 tons of ammonia, or $46.70 per ton (2.335c. per lb.). The cost of the contained nitrogen is 2.83c. per lb.

Sulphuric Acid Plant.—As the cost of sulphur has been going up and the end is not in sight, cheap sulphuric acid is not on the market. Free-roasting pyrite or that containing over 35 per cent of sulphur is also increasing in price, but there is much low-grade pyrite available at little more than the cost of mining and transportation. There is also available the pyritic refuse of coal washeries. To roast 25 per cent sulphur content pyrite with air requires about a ton of coal per ton of sulphur recovered, and more than this if the cinder is to be desulphurized sufficiently for it to be salable. By using oxygen we can have sulphur dioxide free of nitrogen and produce a clinker that will be practically free of sulphur. This low-grade pyrite is taken at $2.50 per ton and the credit for the cinder is taken at the same value.

By using oxygen at $8 per ton and applying the credit for the cinder we have sulphur dioxide at less than the cost of burning $16 brimstone with air, and we have it free of nitrogen which is a considerable advantage in the contact process of making sulphuric acid. Approximately 80,000 tons of 25 per cent pyrite and 25,000 tons of oxygen will produce 80,000 tons of 60-deg. acid at a cost of $640,000 or $8 per ton.

Ammonium Sulphate Plant.—This plant is of standard design and delivers 80,000 tons of ammonium sulphate at a cost including ammonia and acid of $1,839,000 equivalent to $23 per ton.

Cost per lb. of ammonium sulphate 1.15c.
Cost per lb. of contained nitrogen 5.42c.

Nitric Acid Plant.—Oxygen enrichment of the air-ammonia mixture of the catalytic oxidation process produces economy and promotes safety. An increase of the oxygen content of the air by about 50 per cent will allow an ammonia concentration in excess of 12 per cent and produces an acid of about 62.5 per cent concentration. The cost of the oxygen is returned in the greater value of the acid of higher concentration, but there are considerable savings in the cost of plant and in operating expense. Including the cost of the ammonia and oxygen in the total, we have as the cost of producing 50,000 tons of 62.5 per cent acid the sum of $1,008,000 equivalent to $20.14 per ton.

Cost per lb. of nitric acid 1.007c.
Cost per lb. of contained nitrogen 4.48c.

Ammonium Nitrate Plant.—This is a standard plant

and will deliver 64,000 tons of ammonium nitrate for $1,792,600 including the manufacturing costs of all materials.

Cost per lb. of ammonium nitrate	1.4c.
Cost per lb. of contained nitrogen	4.0c.

Ammonium Sulphate-Nitrate Plant.—This is an ordinary mixing and evaporating operation. The cost including the manufacturing costs of the sulphate and the nitrate and of bagging for shipment is $3,861,600 per 144,000 tons of product.

Cost per ton of ammonium sulphate-nitrate	$26.82
Cost per lb. of ammonium sulphate-nitrate	1.341c.
Cost per lb. contained nitrogen	4.67c.

Summary:

Manufacturing cost	$3,861,600
Overhead	1,800,000
Total cost of 144,000 tons	$5,661,600
Cost per ton	$ 38.63
Cost per lb. of contained nitrogen	6.73c.

Taking the cost of handling, storing, mixing and transportation at $30 per ton, we have as the cost to the ultimate consumer $68.63 per ton, which would bring the cost of the contained nitrogen to 12c. per lb. When power costs $15 per hp.-yr. the cost of contained nitrogen to the ultimate consumer should not exceed 11c. per lb., and when power is obtainable at $10 per hp.-yr. the nitrogen cost should be less than 10c. per lb.

Oxygen.—All of the hydrogen produced is used in the manufacture of ammonia. Incident to producing the hydrogen we have generated about 88,000 tons of oxygen, of which amount 35,000 tons is used in the processes at the rate of $8 per ton. There is 53,000 tons which must be used or sold at $7.75 per ton to cover the cost.

Possibilities of Oxygen Enrichment

There are numerous electric furnace operations which could be readily carried out in the blast furnace if operating temperatures could be increased. Oxygen enrichment of air will do this, and when coke costs $8 per ton the process can afford oxygen at $12 per ton. There are several chemical processes where the use of oxygen at $12 per ton will effect economies even greater than has been demonstrated for sulphuric acid. The oxygen from the cells will be 99.5 per cent pure and can be made 99.95 per cent pure at a cost not to exceed 5c. per 1,000 cu.ft.

In operations where coal or coke is used in the manufacture of gas the value of oxygen is directly proportional to the cost of the coal or coke. As an example we may take a water-gas plant. By the use of oxygen we may eliminate the "blow" and "make" feature of the standard apparatus substituting therefor a continuous oxygen-fed generator. Relying on my own experimental data, which seems to be confirmed by the reports of Prof. S. W. Parr, I will state that when coke costs $8 per ton, oxygen has a value of $12 per ton because of the savings effected by its use.

The number of uses for cheap oxygen is far too great for treatment here, but I believe that enough applications have been cited to indicate that the oxygen part of the hydrogen problem of synthetic ammonia can be solved, and that its solution points the way to cheaper fixed nitrogen for agriculture and for industry.

Toronto, Ontario. FARLEY G. CLARK,
Consulting Engineer.

Another Unauthorized Representative

To the Editor of Chem. & Met.:

Sir—The Commercial Solvents Corporation is informed that one W. F. Campbell, of various addresses in Newark, New Jersey and Denver, Colorado, is going about the country selling formulas which it is alleged will produce "celluloid enamels," "celluloid inks," etc.

Mr. Campbell has intimated that his operations have in some measure the sanction of the Commercial Solvents Corporation. The trade is asked to note that Commercial Solvents Corporation has never had any dealings whatsoever with Mr. Campbell.

Terre Haute, Ind. HENRY DENNY,
Commercial Solvents Corporation.

Lincoln Arc Welding Prize

To the Editor of Chem. & Met.:

Sir—In submitting essays for the Lincoln Arc Welding Prize, contestants may profit from the following suggestions made by the donors. Arc welding applications can be divided in three general classes: (1) Where welding replaces riveting; (2) Where welding replaces castings; (3) Where special designs possible only with arc welding will replace present-day designs at a saving either in cost of production or in resultant work.

Taking these classifications in order, arc welding will replace riveting on structures such as buildings, bridges, boats, boilers, tanks and pressure vessels. The problems here are the origination of designs which will use arc welding to the best advantage and the most economically, and also for methods whereby the erection of the parts may be done at the lowest possible cost. This is particularly true in the erection of fabricated steel in buildings, bridges and boats. A method of accomplishing this, which is commercially economical, would be of great value. Also, the fabrication of girders and columns with maximum resistance to failure at minimum cost, is something on which a tremendous amount of work can be done with profit.

The second classification is the replacement of cast structures with welded steel construction—its advantage is self-evident because of the greater strength, stiffness and lower cost of the steel as compared with cast iron. It would be suggested that Diesel engines, radiators, cast-iron pipe, boilers and bases for machinery and like structures, can be replaced with enormous economies both in first cost and frequently in operating cost by the substitution. The actual designing of this substitution, however, is a problem of enormous importance. In this same line can be put machine tools of all kinds, automobile engines and the run of mine castings of the job foundry.

Under the third classification comes the large division of building-up operations, such as switch points, cross overs, railroad rails, oil stills and all the many parts which from wear become obsolete or useless.

There are a number of other applications which perhaps do not come directly under the foregoing classifications, such as the manufacture of poles; towers from structural steel; the method of welded joint inspection so as to determine its strength without test; the making of field joints in pipe lines; the manufacture of agricultural machinery; the manufacture of rubber tire molds from steel. Also, under this classification would come, lastly (what is perhaps the most important single

thing in this matter), getting the facts regarding the advantages of arc welding into the minds of engineers and the general public so that its advantages will be understood.

THE LINCOLN ELECTRIC CO.

Cleveland, Ohio.

Recovery of Sulphur from Gas

To the Editor of Chem. & Met.:

Sir—In your issue of March, 1927, appeared an article written by myself and entitled "Recovery of Sulphur from Gas."

My attention has been called to the fact that the paragraph entitled "Acknowledgment" was unintentionally so worded as to make an erroneous impression. The purpose of this letter is to correct such impression. The fact of the matter is that the chemistry and application of the catalytic activation reaction which results in the recovery of sulphur was worked out by Dr. L. Rosenstein, assisted by his staff, consisting of Dr. R. A. Morgen and F. M. Eaton. The technical staff of the Pacific Gas & Electric Co., including myself, co-operated with the above mentioned, and the final process as practiced today is the result of our combined efforts, although the original conception and plan of attack of the problem is due to Dr. Rosenstein.

KENNETH N. CUNDALL.

San Francisco, Calif.

To the Editor of Chem. & Met.:

Sir—Referring to the article entitled "Recovery of Sulphur from Gas," by K. N. Cundall, published in the March, 1927 number of your journal: I found it necessary because of certain financial interests which have arisen out of the development of this process, to call Mr. Cundall's attention to what seemed to me to be an erroneous impression created by the paragraph entitled "Acknowledgment." Patents on the process are still pending. Mr. Cundall has very generously proposed to correct any error that may have arisen from the wording of this paragraph.

It gives me pleasure at this point to acknowledge that the investigation was carried on for the Pacific Gas and Electric Co. and was financed by them. Shop rights under patents which were applied for while the work was in progress have been acquired by said company.

LUDWIG ROSENSTEIN,
Consulting Chemist and Chemical Engineer.

San Francisco, Calif.

An Old Soldier Speaks

To the Editor of Chem. & Met.:

Sir—As a regular reader of your valued paper, I feel I have the right to speak my mind to you when something important comes up. To set things right at the start, I want it known that I am not writing in to quarrel with you but to set you straight on some matters.

What I have on my mind is the full-page editorial on gas warfare in the March issue of your publication. As a "soldier of the old school," I protest against it. As an officer of the old *infantry* school, I go so far as to inveigh against it.

In your discussion of gas as the future agency of war, you show a woeful lack of information or hide complete knowledge of cavalry, machine guns, indirect fire, liaison of artillery with infantry; liaison of airplanes with infantry; the use of the buzzerphone, blinker and semaphore in terrain exercises; the functions of the captive balloon and the duties of the commander of an advance party. In addition, you appear to know nothing about accompanying guns, the duties of a brigade adjutant, the duties of a regimental runner; why is sunshine wire? what is a field order? what a quartermaster dump looks like; o.d. pills, wound stripes, the chauchat rifle, lines of strong points, getting information to command and the real function of the airplane in warfare.

These matters are all important and have bearing on the subject. How can you cut all these things out and still have a war? Maybe you think the cavalry soldiers, anxious to become horses de combat, would run deliberately into tear gas, so they could be sent to the rear. Well, that may be funny, but it is not war, as we of the army would say.

No, Mr. Editor. You are a good writer and your stuff reads well, but you cannot—you *must* not—attempt to remove the pomp, the ceremony, the noise and the panoply of war at one fell swoop. It will take at least a half dozen fell swoops to do it. And you must reserve one swoop, fell, complete, for the General Staff.

As a veteran of the Great War—the greatest it has been my good fortune to see so far—I protest against Mr. Wells's remarks about uniformed troops not serving any useful purpose, and against your approval of that same remark. Uniformed troops are a lot of good. Can you imagine *un*uniformed troops?

Now for a secret: I don't care what we fight with in the future, so long as we continue to have wars. Can you imagine the United States not having a war every so often? We beat the world in the number we have fought so far, and it would be unAmerican, positively disloyal, to change things in this direction.

Gas or no gas, yours for more and better wars.

Upper Montclair, N. J. F. A. GEE.
Pro Bono La Guerre

New Method of Appeals on Patent Applications Now in Effect

A change in procedure in the United States Patent Office with respect to appeals on patent applications went into effect May 2, when the reorganized Board of Patent Appeals was established as provided by an act of the last Congress. The Board will function as the single patent appellate tribunal of the Patent office, thus replacing the dual method of appeal formerly practiced. The Board comprises the commissioner and the two assistant commissioners of patents and the six examiners-in-chief, any three of whom may constitute a quorum.

Previously, the original appeal from office rejections was heard by the Board of Appeals, from whose decision appeal could be had to the commissioner of patents. From the commissioner's decision, appellate jurisdiction was vested in the Court of Appeals of the District of Columbia. Under the reorganized plan it is designed that the single appellate tribunal will always include the commissioner or one of his assistants, sitting with two of the examiners-in-chief. Appeals from this body will, however, still be heard by the District Court of Appeals.

The two appellate bodies formerly existing in the Patent Office necessitated two pleadings of the case, two decisions and double preparation for the hearings.

Selections from Recent Literature

Electrolytic Copper. C. Rothert and A. Tuteur, *Chemiker-Zeitung*, March 23, pp. 219-21. The necessary conditions for imparting the best properties to electrolytic Cu were studied. Active agitation of the solution is advised. Elongation is increased by increasing content of $CuSO_4$ or H_2SO_4, with hardly any effect on tensile strength. Increasing current density increases tensile strength and decreases elongation. The cathode material is an important factor in quality. Illustrated.

Technology in 1926. First annual "Progress Report," *Chemiker-Zeitung*, March 23, Supplement, 32 pp: Pharmaceuticals, S. Rabow, pp. 1-7, 332 references; Beet Sugar, E. O. von Lippman, pp. 7-10; Glue, Richard Kissling, pp. 10-3, 207 references; Essential Oils and Perfumes, H. von Soden, pp. 13-32, 416 references.

Dissolving Cellulose. Paul Bary, *Revue generale des matieres plastiques*, March, pp. 131ff. Those methods of dissolving or dispersing cellulose which depend on the use of concentrated aqueous solutions of inorganic salts have some advantages over present commercial methods, such as the viscose process. The use of thiocyanate solutions appears to be particularly promising from the industrial standpoint. The work of Hibbert, Schorger, von Veimarn, Herzog, Dubosc and others is reviewed.

Reclaiming Rubber. Paul Bary, *Revue generale des matieres plastiques*, March, pp. 176-8. The alkali process is discussed; the apparatus used in the Willard process is described and illustrated, and factors governing quality of the reclaim are listed. The Olier autoclave and the Repiquet device for filtering reclaims are also described and illustrated.

Glass Technology. W. E. S. Turner, *Chemistry and Industry*, March 18, pp. 234-5. A lecture on economic considerations, recent technical advances and present lines of progress in the glass industry.

Liquid Chlorine. D. A. Pritchard and J. A. Hubel, *Chemistry and Industry*, March 18, pp. 230-3; March 25, pp. 253-7. The manufacture of liquid chlorine by electrolysis of brine, as carrier out at the Sandwich Plant of the Canadian Salt Co. is described. Commercial outlets include bleaching in various industries; sterilizing water, sewage and the like; metallurgy; petroleum refining; synthetic HCl and military uses. Ways and means of tank car transportation are described. Illustrated.

Sulphuric Acid. W. H. De Blois, *Chemistry and Industry*, March 25, pp. 257-63. The contact process is described in some detail and briefly compared with the chamber process. The principal advantage of the contact process is the relative ease of production of concentrated acid and oleum. Specific reference is made to the construction and operation of the plant which makes sulphuric acid as a by-product from the nickel smelters of the Mond Company in Canada.

Heat Insulation. J. S. F. Gard, *Journal of the Society of Chemical Industry*, March 25, pp. 101-5T. Qualities required in a heat insulator; applications in industry; methods of measuring heat conductivity. Illustrated with tables, curves and one photograph.

Mixing. Paul Gundlach, *Farbe und Lack*, March 16, pp. 138-9. Illustrated description of mixing machinery used in varnish and lacquer manufacture.

Milling Flour. Morris Katz, *Canadian Chemistry and Metallurgy*, April, pp. 87-9. A description of the processes and machinery used in cleaning wheat and in the successive steps of break roll grinding, grading, purifying, reducing on smooth rolls and dressing. There is also a discussion of the testing and analysis of flour.

Yeast Products. A. Linton Davidson, A description of the manufacture of yeast from beer wort, and the production of nucleic acid and yeast foods such as pressed yeast, yeast extract, etc. The dietetic and medicinal uses of yeast and its products are discussed.

Sulphuric Acid. Peter P. Budnikoff, *Chemiker-Zeitung*, March 19, pp. 209-10. The purification and washing of the gases for making H_2SO_4 by the Tentelew process in Russia involve the use of the Tentelew cooler, washer and washing tower. These are described and illustrated by drawings.

Naphthalene. A. von Skopnik, *Chemiker-Zeitung*, March 19, pp. 211-2. Modern German practice in the large-scale production of pure naphthalene by distillation is described. A time-temperature curve is given to show the course of a typical naphthalene distillation at the sublimation temperature.

Battery Depolarizer. A. Wagner, *Chemiker-Zeitung*, March 9, pp. 179-81. In the manufacture of dry cells, artificial MnO_2 has several advantages over the natural product; but it needs to be stabilized, e.g., by admixture of some natural MnO_2. It is also difficult to produce in a useful crystalline state from Weldon mud and like sources of the artificial product. These difficulties have been largely overcome, and a satisfactory artificial MnO_2 is available to the battery industry.

Lubricating Oils. R. A. Wischin, *Chemiker-Zeitung*, March 9, pp. 181-2. A discussion of the refining of waste or spent oils as an effective means of cutting down lubrication costs. Particular emphasis is given to filtration with floridin. Other clarifying (adsorption) agents are also discussed, including silica gel, fuller's earth, active carbon, etc.

Aluminum Acetate. F. Chemnitius, *Chemiker-Zeitung*, March 19, p. 210. A factory process for making Al acetate by treating the sulphate with $CaCO_3$ and neutralizing the resulting $Al(OH)_3$ with acetic acid. With two wood vats, the monthly production would be about 8,000 kg.

Aluminum Ware. H. Röhrig, *Chemiker-Zeitung*, March 30, pp. 237-8. Aluminum, as Al ware or as a material of construction, is useful for many chemical processes and products, including nitric acid, explosives, coke by-products, petroleum refining, fats and oils, fermentation industries and dyes. Many alloys are in use. In some cases the metal is given a protective coating.

Clarifying Lacquers. Adolf Heck, *Farbe und Lack*, March 23, p. 151. Processes of filtering and centrifuging are briefly discussed, and the advantages of the Union filter-centrifuge are set forth in detail. Illustrated.

Coking. Etienne Audibert and Louis Delmas, *Chimie et Industrie*, March, pp. 355-66. A study, illustrated with photomicrographs, of the mechanism of the coking of coal. Curves are shown in which volume increase is plotted against time and against temperature. The structure of the coke was studied with respect to the effect of time, temperature and uniformity of heating, the nature of the original coal being duly considered.

Oxidizing Gasoline. Michael Freund, *Zeitschrift für angewandte Chemie*, March 31, pp. 368-74. A Galician gasoline (paraffin base) and a cracked gasoline (from western U. S.) were oxidized by passing the vapor, mixed with air, over petroleum coke at 400-500 deg. C. The reaction involved both pyrolysis and oxidation. The products included carboxylic acids, esters, alcohols, phenols, aromatic and unsaturated (acyclic) hydrocarbons, with some CO_2 and H_2O. The amount of combustion increased if time, temperature or air content of the gas increased.

Coke Formation. R. A. Mott, *Journal* of the Society of Chemical Industry, March 11, pp. 85-92T. If calculated on the ash free, dry, sulphur free basis there is a fairly simple relation between coking properties and composition of coal. In general, bright coals with more than 85 per cent (and probably less than 91 per cent) carbon are coking coals; the richer in carbon, the better. Coke formation probably depends on solid surface flow under pressure, solvent action of escaping liquids, and passage of gases through the mass.

Domestic Fuel. Margaret F. Bligh and H. J. Hodsman, *Journal of the Society of Chemical Industry*, March 11, pp. 92-9T. The modern barless grate design is unsuitable for burning coke, which lacks the volatile matter needed for easy burning in an open grate. The relatively high ash content of carbonized fuels is also unfavorable to open grate combustion. Coke can be burned successfully without much chimney draft, but a well insulated fire back is essential to good heat radiation. Soda makes the coke burn more freely and brightly, but lessens the radiation efficiency.

Electrochemical Oxidation. F. Fichter and Max Rinderspacher, *Helvetica Chimica Acta*, Feb., pp. 40-52, 102-6. Emulsions of *o*-xylene, *o*-xylenol, ethylbenzene (by Kashichi Ono), thymol and iso-eugenol in dilute H_2SO_4 gave aldehydes and quinones as principal products of electrochemical oxidation. A peculiarity of the xylenes is that

o-xylene yields the meta quinone, and *m*-xylene yields the para quinone. The experimental details of the oxidations are described in some detail.

Dyes from Naphthalene. F. Kehrmann and B. Perrot, *Helvetica Chimica Acta*, Feb., pp. 53-61. The condensation product of benzil and phenyltriaminonaphthalene is the starting point for a number of dyes. Its acyl derivatives and its condensation products with other compounds (such as hydroxynapthaquinone) give a wide range of blue, red and yellow shades.

Sulphonating Anthraquinone. Andre Meyer, *Comptes rendus de l'Academie des Sciences*, March 7, pp. 609-11. It has now been established that Hg is necessary for the conversion of the alpha acid to beta-anthraquinone sulphonic acid. The products of sulphonation for 90 minutes at 160 deg. C. with oleum (50 per cent SO_3) in presence of $HgSO_4$ were: unchanged anthraquinone, 17 per cent; monosulphonic acid (alpha), 57 per cent; disulphonic acids (1,5 and 1,8), 20 per cent; trisulphonic acid, 3 per cent.

Spray Drier. *Industrial Chemist*, March, pp. 104-8. A description, illustrated with drawings and photographs, of a new design by the Kestner Co. It is particularly useful for relatively unstable products, e.g. in making milk or egg powders, meat extracts, sugars and sirups, pharmaceuticals, etc. The atomizer is so made that viscous liquids can be treated, thus removing one of the limitations of older designs.

Airplane Dopes. H. T. S. Britton, *Industrial Chemist*, March, pp. 116-20. A description of the manufacture of acetate and nitrate dopes. Plasticizers are discussed, with particular emphasis on triphenyl phosphate. Recipes are given to show the use of pigments and other agents for flameproofing and protecting the dopes against deterioration by light. Curves for viscosity and tensile strength of dope films are shown.

Fluid Meters. H. Moren Brown, *Industrial Chemist*, March, pp. 128-32. The principle of the Electroflo meter is described and illustrated. The orifice plate method, the rounded nozzle method, the Pitot tube, the MacGregor anemometer, the Thomas meter and the Lea recorder are also described and illustrated.

Steel Fractures. P. W. Priestley, *Industrial Chemist*, Feb., pp. 63-6. A discussion of the causes leading to failure of steel in service, and of the interpretation of these causes by microscopic and other methods of examination. The principal factors in failure are chemical compositions, casting treatment, mechanical working, heat treatment and abuse. Illustrated with photographs.

Solvent Recovery. *Industrial Chemist*, Feb., pp. 67-72. A description, illustrated with drawings and photographs, of the application of the streamline filter to the reclamation of solvents used in dry cleaning establishments. Centrifugal clarification is similarly treated in the March issue (pp. 109-12).

Nitration. Harry Raudnitz, *Berichte der deutschen chemischen Gesellschaft*, March 9, pp. 738-43. Ethyl nitrate is an effective nitrating agent for diphenyl, carbazole, and other polynuclear compounds. On a laboratory scale it forms, for example, dinitro-anthraquinone in 30 min. at —5 deg. C., as compared with hours of boiling required when fuming nitric acid is used.

Gas Fired Boilers. J. Hudler, *Feuerungstechnik*, Jan., pp. 73-6. A study of the most efficient methods and equipment for production of generator gas to be used as fuel under large or high pressure boiler.

Dry Cells. A. Wagner, *Chemiker-Zeitung*, March 9, pp. 179-81. A discussion of the manufacture of dry batteries, with particular reference to the production and properties of MnO_2 for use as depolarizer. By the use of an artificial MnO_2, battery service has been much improved without a corresponding price increase.

Varnish Plant. *Farbe und Lack*, March 9, pp. 122-4. Plans and drawings showing an approved layout for the construction of a modern varnish factory for an output of 50,000 to 100,000 kg. per month. The plan is for a four-story building; each floor is considered separately.

Making Varnish. Hans Rebs, *Farbe und Lack*, March 9, p. 128. A new method in varnish manufacture. As an example, floor varnish should be made in 4 steps: (1) making the Ca resinate or resin ester; (2) preparing a thickened mix of tung and linseed oils; (3) mixing resin and oil, excluding possibility of chemical changes; and (4) dilution and addition of drier. A plant for carrying out this process is illustrated.

Acetic Acid. L. Eberlein, *Chemiker-Zeitung*, March 16, pp. 198-200. A description of present practice in the production of vinegar and acetic acid.

Government Publications

Prices indicated are charged by the Superintendent of Documents, Washington, D. C., for pamphlets. Send cash or money order; stamps and personal checks not accepted. When no price is indicated, pamphlet is free and should be ordered from Bureau responsible for issue.

Production and Utilization of Fats, Fatty Oils, and Waxes in the United States, by George S. Jamieson. Department of Agriculture Department Bulletin No. 1475. 10 cents.

Lubrication and Instructions for the Operation, Care, and Repair of Lubrication Systems. Bureau of Engineering, Navy Department, Reprint of Chapter 10 of the Manual of Engineering Instructions, revision of June, 1926. 10 cents.

Paper and Paper Products in the River Plate Countries and Bolivia, compiled by Norman S. Meese. Bureau of Foreign and Domestic Commerce Trade Information Bulletin 459. 10 cents.

Foreign Trade of the United States in the Calendar Year 1926. Bureau of Foreign and Domestic Commerce Trade Information Bulletin 460. 10 cents.

Denaturization of Industrial Alcohol —Laws Pertaining to the Denaturization of Industrial Alcohol; the Existing Regulations; and Copies of the Formulae Now in Effect. Senate Document No. 195, 69th Congress, Second Session. 15 cents.

Safety Codes for the Prevention of Dust Explosions. Bureau of Labor Statistics Bulletin 433. 10 cents.

Record of Industrial Accidents in the United States to 1925. Bureau of Labor Statistics Bulletin 425. 20 cents.

The Iron-Ore Situation in the South, by Ernest F. Burchard. Mimeographed statement issued by the U. S. Geological Survey.

Pulp-Wood Consumption and Wood-Pulp Production, 1925. A Bureau of the Census 1925 Census of Manufacturers pamphlet. 5 cents.

Chrome Vanadium Steel, Sheet or Strip. Navy Department Specifications 47S12.

Acetone. Navy Department Specifications 51A4b.

Dusting with Monohydrated Copper Sulphate and Lime for Control of Pecan Scab. Department of Agriculture Department Circular 412-C.

Alphabetical Index and Numerical List of United States Government Master Specifications, Promulgated by the Federal Specifications Board. Bureau of Standards Circular 319. 10 cents.

Puncture-Sealing Compounds for Pneumatic Tires. Bureau of Standards Circular 320. 5 cents.

Stucco Investigations at the Bureau of Standards, with Recommendations for Portland Cement Stucco Construction. Bureau of Standards Circular 311. 15 cents.

Measurement of Surface Tension, by N. Ernest Dorsey. Bureau of Standards Scientific Paper 540. 15 cents.

Relationships Between the Rockwell and Brinell Numbers, by S. N. Petrenko. Bureau of Standards Technologic Paper 334. 15 cents.

Carbon Brushes and Brush Shunts. Department of Commerce Simplified Practice Recommendation No. 56. 5 cents.

Engine Service Tests of Internal-Combustion Engine Lubricating Oils Made from California Crude Petroleum, by Martin J. Gavin and Gustav Wade. Bureau of Mines Technical Paper 387. 15 cents.

Some Feldspathic Materials of the Pacific Northwest, by Hewitt Wilson. Bureau of Mines Serial No. 2794.

Fifteenth Semi-Annual Motor Gasoline Survey, by E. C. Lane and Peter Grandone. Bureau of Mines Serial No. 2795.

Mineral Production Statistics for 1925—Separate pamphlets from Bureau of Mines on: Tin, by J. W. Furness, 5 cents; and Cement, by B. W. Bagley, 5 cents.

Mineral Production Statistics for 1926—Preliminary mimeographed statements from Bureau of Mines on: Aluminum, Bauxite, Magnesite, Magnesium, Magnesium Salts, Fuel Briquet Industry, Beehive and By-Product Coke, and Fluorspar.

Production statistics from 1925 Census of Manufactures in preliminary mimeographed form for: Manufactures of Nonferrous Metals and Alloys, Steel-Works and Rolling-Mill Products, Fertilizers, and Wire and Wire Products.

The Plant Notebook

An Exchange for Operating Men

Heating and Process Steam From Turbine Exhaust

Two turbine generators installed at the plant of the Athena Glazed Brick Co. at Nelsonville, Ohio, supply all electric power needed for the running of the plant, and ample steam for heating and process work is furnished without additional cost. This concern manufactures clay products such as face bricks and special forms of salt glazed ware used for flooring in garages, slaughter houses, breweries, bath houses, etc.

Two General Electric turbine generators are used, one rated 300 kilowatts and the other, 100 kilowatts. The electrical output of these units is used for lighting the factory and for handling the motor load consisting of approximately 500 horsepower in induction and synchronous motors. These motors drive motor generators, operate a coal mine and drive grinding machines, brick machines, dry pans, elevators, and other production machinery.

Exhaust steam from the turbines ranging in pressure up to a maximum of 16 pounds is used for heating a number of the factory buildings and for drying the clay products. Reclaimed heat from the kilns is also used for drying, but was found to be less suitable for the purpose than steam heat which can be more closely controlled.

An analysis of operating data made after the installation was completed showed that the necessary electric power was being furnished at no greater cost than before, while the steam for heating and drying was obtained without additional cost.

Calibration Table for Cylindrical Tanks

By T. F. Corcoran
Louviers, Colorado

In *Chem. & Met.* for October 27, 1924 there appeared a table of factors for simplifying the work involved in calibrating cylindrical tanks in a horizontal position. A similar table, probably more useful because of the smaller difference between successive values of the per cent and diameter, appears in Sullivan's Sulphuric Acid Handbook. These tables can be further simplified in their application to most of the tanks that are met with in practice because of the fact that most tanks are made up with diameters of whole feet and with ends having a radius equal to the diameter of the tank. The attached table has been made up to include practically every tank on several of the du Pont company's acid plants and permits making calibrations with a minimum of effort.

The formula to be used with the table which you published as noted above, is as follows:

$$V = Xa^2l - Ya^3$$

Where X is the cylinder coefficient corresponding to a given per cent depth of liquid, a is the radius of the tank, l its length, and Y the end coefficient corresponding to the given per cent depth. Several calculations are thus required.

In the attached table, the depth is expressed directly in inches and the coefficient C represents the volume in cubic feet of a tank one foot long. The volume of the end portions is of course independent of the length of the tank. All that is required with this table is to multiply the coefficient C at any given depth in inches by the length of the tank and add or subtract the volume of the end portions corresponding to the given depth.

This table has been made up to only 50 per cent of the tank depth because it has been used mainly for making up calibration tables for each individual tank, this being desirable where the tanks are measured frequently. However, if a tank is more than half full it is a simple matter to subtract the volume of the empty space from the total volume of the tank.

The values have been carefully checked and are believed to be accurate within the limits of error in tank measurement.

The writer has checked the dimensions of about one hundred tanks and has found that the diameter is nearly always very close to the specifications, but the length varies by a few inches. For example, about twenty 8x20 ft. tanks were measured and all were found to have the exact inside diameter while the length was a few inches more for tanks with heads convex outward and a few inches less for tanks with heads convex inward.

In.	3 Ft. Diam.		4 Ft. Diam.		4½ Ft. Diam.		5 Ft. Diam.		6 Ft. Diam.		7 Ft. Diam.		8 Ft. Diam.		10 Ft. Diam.		In.
	C	V_H	C	V_H	C	V_H	C	V_H	C	V_H	C	V_H	C	V_H	C	V_H	
1	.056	...	.064	...	.070	...	.074	...	.079	...	.086	...	.090	...	.101	...	1
2	.157	...	.181	...	.190	...	.198	...	.223	...	.241	...	.258	...	.286	.1	2
3	.280	...	.331	...	.352	...	.367	...	.408	.1	.441	.1	.461	.1	.523	.1	3
4	.428	...	.498	.1	.531	.1	.566	.1	.625	.1	.677	.1	.725	.1	.791	.2	4
5	.595	.1	.693	.1	.744	.1	.777	.1	.852	.2	.942	.2	.996	.2	1.123	.3	5
6	.777	.1	.907	.2	.965	.2	1.022	.2	1.119	.3	1.209	.3	1.324	.3	1.468	.4	6
7	.963	.2	1.136	.2	1.215	.3	1.286	.3	1.407	.4	1.523	.4	1.645	.4	1.830	.5	7
8	1.168	.3	1.381	.3	1.457	.4	1.551	.4	1.715	.5	1.858	.6	1.989	.6	2.265	.7	8
9	1.382	.4	1.637	.4	1.747	.5	1.847	.5	2.040	.6	2.212	.8	2.388	.8	2.676	.9	9
10	1.604	.5	1.893	.5	2.025	.6	2.157	.6	3.381	.8	2.584	1.0	2.771	1.0	3.108	1.1	10
11	1.833	.6	2.170	.6	2.330	.7	2.461	.8	2.737	1.0	2.973	1.2	3.211	1.2	3.616	1.4	11
12	2.058	.7	2.458	.8	2.628	.9	2.796	1.0	3.106	1.2	3.377	1.4	3.626	1.5	4.088	1.7	12
13	2.300	.8	2.752	1.0	2.952	1.1	3.141	1.2	3.488	1.4	3.664	1.6	4.100	1.8	4.576	2.1	13
14	2.544	.9	3.054	1.2	3.268	1.3	3.475	1.4	3.895	1.6	4.228	1.9	4.546	2.1	5.145	2.5	14
15	2.791	1.0	3.362	1.4	3.609	1.5	3.839	1.7	4.258	1.9	4.673	2.2	5.004	2.4	5.666	2.9	15
16	3.031	1.1	3.661	1.6	3.939	1.7	4.210	2.0	4.672	2.2	5.129	2.5	5.523	2.8	6.203	3.4	16
17	3.282	1.3	3.981	1.8	4.293	1.9	4.568	2.3	5.095	2.5	5.558	2.9	6.006	3.3	6.823	3.9	17
18	3.534	1.5	4.304	2.0	4.634	2.1	4.954	2.6	5.528	2.8	6.035	3.3	6.549	3.8	7.388	4.4	18
19			4.632	2.2	5.000	2.4	5.347	2.9	5.968	3.1	6.522	3.7	7.055	4.3	7.965	5.0	19
20			4.962	2.4	5.350	2.7	5.722	3.2	6.416	3.5	7.019	4.2	7.569	4.8	8.629	5.6	20
21			5.294	2.6	5.723	3.0	6.125	3.5	6.871	3.9	7.523	4.7	8.147	5.3	9.231	6.3	21
22			5.613	2.9	6.100	3.3	6.532	3.8	7.332	4.3	8.037	5.2	8.680	5.8	9.845	7.0	22
23			5.447	3.2	6.459	3.6	6.920	4.1	7.783	4.8	8.558	5.8	9.277	6.4	10.547	7.7	23
24			6.283	3.5	6.841	3.9	7.334	4.4	8.239	5.3	9.086	6.4	9.827	7.0	11.182	8.4	24
25					7.204	4.2	7.752	4.8	8.716	5.8	9.621	7.0	10.385	7.7	11.827	9.2	25
26					7.578	4.6	8.148	5.2	9.198	6.3	10.162	7.6	11.007	8.4	12.563	10.0	26
27					7.952	5.0	8.570	5.6	9.684	6.8	10.662	8.2	11.579	9.1	13.227	10.8	27
28							8.993	6.0	10.174	7.3	11.214	8.8	12.216	9.8	13.900	11.7	28
29							9.393	6.4	10.667	7.8	11.771	9.4	12.800	10.5	14.666	12.6	29
30							9.818	6.8	11.163	8.3	12.332	10.0	13.450	11.2	15.355	13.6	30
31									11.661	8.8	12.897	10.6	14.046	11.9	16.051	14.6	31
32									12.126	9.3	13.467	11.2	14.647	12.7	16.843	15.7	32
33									12.627	9.8	14.039	11.8	15.313	13.5	17.554	16.8	33
34									13.130	10.4	14.615	12.4	15.923	14.3	18.272	17.9	34
35									13.633	11.0	15.194	13.0	16.599	15.1	19.087	19.1	35
36									14.137	11.7	15.775	13.7	17.217	16.0	19.817	20.3	36
											16.358	14.5	17.838	16.9	20.553	21.5	37
											16.943	15.3	18.525	17.8	21.387	22.7	38
											17.480	16.1	19.153	18.7	22.134	23.9	39
											18.067	16.9	19.845	19.6	22.886	25.2	40
											18.654	17.7	20.477	20.5	23.737	26.5	41
											19.242	18.5	21.112	21.4	24.498	27.8	42
													21.811	22.4	25.263	29.1	43
													22.448	23.4	26.129	30.5	44
													23.150	24.4	26.901	31.9	45
													23.789	25.5	27.678	33.3	46
													24.493	26.6	28.555	34.7	47
													25.133	27.6	29.337	36.1	48
															30.122	37.5	49
															31.008	38.9	50
															31.798	40.3	51
															32.590	41.7	52
															33.483	43.2	53
															34.278	44.7	54
															35.075	46.2	55
															35.972	47.7	56
															36.771	49.2	57
															37.570	50.8	58
															38.470	52.4	59
															39.270	54.0	60

Tank Calibration Table

For standard tank in horizontal position, radius of heads equal to diameter of tank.

C = cu.ft. per ft. of length of tank cylinder.

V_H = cu.ft. of volume of heads.

L = length of cylinder in feet.

Total volume at any depth of liquid in tank = $CL \pm V_H$, the sign depending upon whether the heads are concave or convex.

For example, a 6x20 ft. tank has 30 in. of liquid. Read opposite 30 in. under 6 ft. diameter. C = 11.163 and V_H = 8.3. The volume of liquid then equals $11.163 \times 20 + 8.3 = 231.6$ cu.ft.

If the tank is more than half full, the volume of the empty space is subtracted from the total volume of the tank. For example, a 5x20 ft. tank, convex heads, contains 52 in. of liquid. Total volume = $(9.818 \times 20 + 6.8) \times 2 = 406.3$ cu.ft. Opposite 8 in., under 5 ft. diameter, C = 1.551 and V_H = 0.4. Then volume of liquid = $406.3 - (1.551 \times 20 + 0.4) = 374.9$ cu.ft.

Charts for Simplifying Routine Calculations

By L. G. Jones
Baltimore, Md.

There are so many complicated calculations made in chemical work that must be worked out individually, that the removal of routine calculations that recur continuously affords considerable relief. There are still many engineers and chemists that make individual computations for repeated operations. This is not only wasteful of time and energy, but makes possible many errors. For the rougher calculations, charts similar to that illustrated could be made up, and the results obtained from them readily. Such results are sufficiently accurate for the majority of routine operations, being within the necessary limits of error.

This particular chart represents the quantity of ammonia, as NH_3, that passes through a process. The laboratory sends out the analyses in grams per liter, while the meters measure the solution in gallons. The final products are in pounds, so that we were interested in knowing the number of pounds of ammonia that were entering the system. The range of operation was from 30,000 to 50,000 gal. per day, while the strength of solution ran from 13 to 25 grams per liter.

From the chart, it would be a matter of seconds to ascertain the number of pounds of ammonia that was charged into the process. Previously it was necessary to convert the analysis into terms of pounds per gallons and multiply by the daily run.

Every department in the plant had charts of a similar nature, giving immediately the quantity of active ingredients charged or derived, with quick determinations of efficiency, etc. Such charts were particularly useful where numbers of small measuring tanks were used, with considerable variation in analysis within certain limits. The measuring tanks were graduated in gallons, and were not uniformly filled. Yet the hourly or daily charge was readily obtainable without calculation.

Such charts are very easily made up, and can be applied to any industry using any solutions or liquids. They are a great help.

Reclaiming Scrap Pipe By Welding

Almost every chemical plant from time to time has relatively large amounts of used pipe that has been replaced by new pipe and has no further use in the plant equipment. As a general rule such pipe is sold to the junkman and the return to the plant realized in this manner is very small.

However, it is possible by means of welding to utilize this pipe for many purposes around the plant. One of the most useful purposes to which this pipe can be put is in the construction of supports for overhead pipe lines and wires. When used in this way the larger sizes of pipe can be made into columns, and smaller sizes can be used for the braces. Latticed towers or A-frames can be built up in this way and when supported on small concrete piers will be found very useful.

Another use for scrap pipe, particularly the smaller sizes, is in the construction of hand rails, machine guards and ladders. All of these are often constructed from new pipe, and the scrap pipe can readily be used to take the place of the new.

Another use suggested for this material is in the construction of wall brackets for the support of pipe lines, motors and other equipment. Such brackets should be made in the conventional triangular or knee-braced construction with plates welded on at the point where the bracket is to anchor into the wall.

Scrap pipe, when not so worn as to be useless, can often be made up into semi-plant scale research apparatus by means of welding. Sections of large pipe can be made into stills or similar equipment. Small and large pipe, welded one within the other, make satisfactory heat exchangers and condensers.

Undoubtedly numerous other uses for this material will come to mind, all of which will serve to turn an otherwise almost valueless material into valuable structures at a consequent profit to the plant.

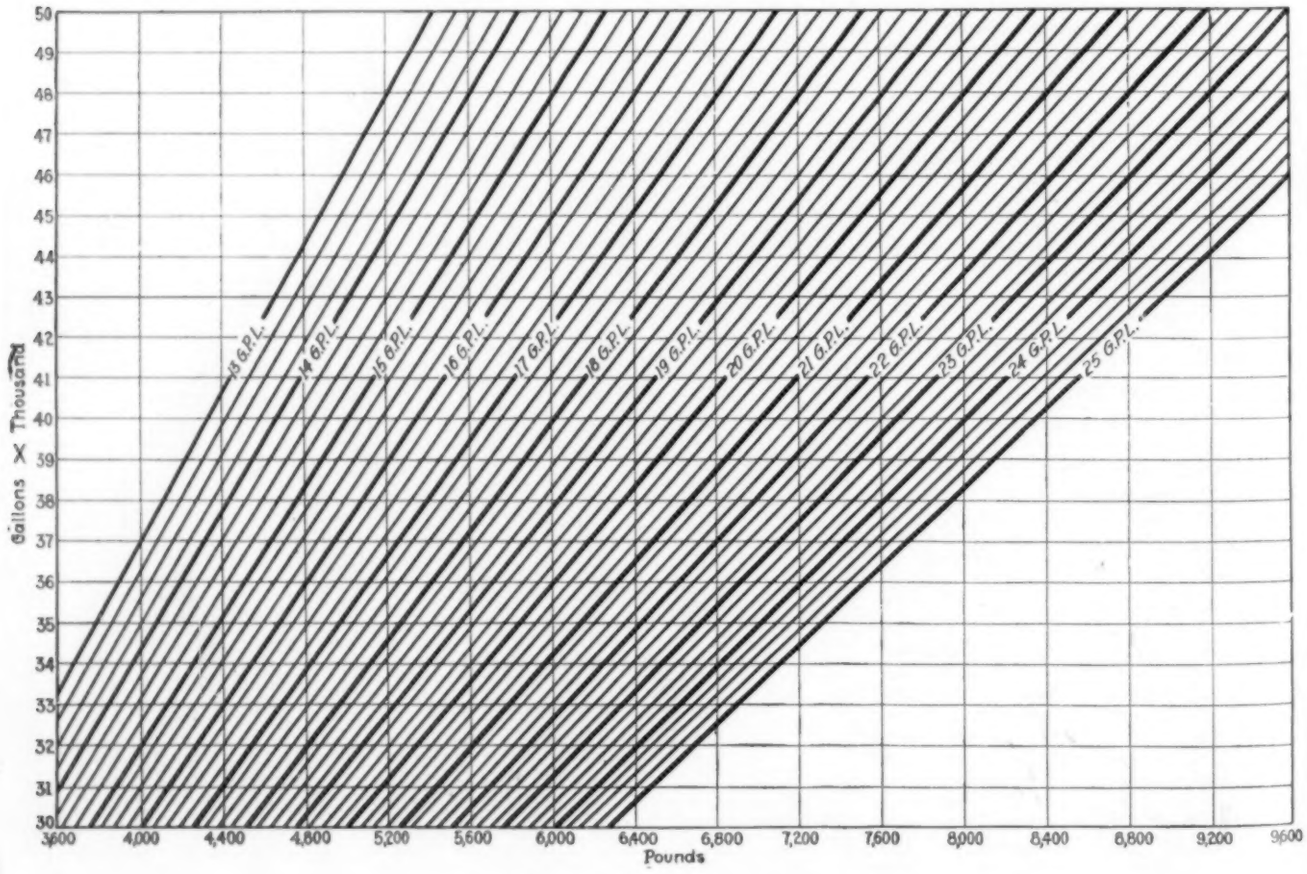


Chart for Simplifying Routine Calculations

This chart, used in a process into which ammonia entered, permitted the quick determination of the pounds of ammonia charged into the process, from laboratory analyses in grams per liter and meter readings of total gallons of solution.

Equipment News

From Maker and User

Speed Reducers

Foote Bros. Gear & Machine Co., Chicago, Ill., has recently placed on the market a complete new line of worm gear speed reducers, known as the "Hygrade," equipped with ball bearings. These machines are of compact design and sturdy construction with a high horsepower capacity per pound of metal used. It is also claimed that the efficiency of these units is much higher than is ordinarily found in worm gear speed reducers of similar ratios and ratings.

Compensator

A new General Electric automatic compensator, of dustproof design for high voltage service, is recommended for service where dust is excessive, such as coal crushing plants, flour mills, etc. This device has a maximum rating of 65 amperes of 2,200 volts.

The side and top covers are securely bolted to angle-iron straps. The back cover is removable but, when in place, is held there by spring clamps. This back cover gives ready access to the current transformers, auto-transformers, wiring and contactor-operating mechanism. The front cover is securely clamped to the base with a flange and gasket around the edge.

The compensator is arranged for conduit wiring. The conduits enter at the back through a bushing plate. The device bears the designation CR-7051-Y-1.

Electrolytic Nickel

The International Nickel Co., 67 Wall St., New York, N. Y., has recently brought out a new grade of electrolytic nickel. This nickel is produced by the Stanley process, but with certain modifications in the electrolytic operation. The new product has a purity of 99.90 per cent, and is claimed to be the highest grade nickel ever produced in quantity on a commercial basis by the company. It is free from both carbon and sulphur.

The material is produced in the standard 27x36 in. cathode weighing approximately 150 lb., or it will be cut into varying sizes of squares down to 1 in., as the trade requires. In this latter form it will be known as "Electro Squares." The company's present capacity for the production of this electrolytic nickel is approximately 750,000 lb. per month, and will be increased as the market develops.

This new nickel is claimed to be particularly adapted to the special requirements of the producers of high-nickel-content alloys, such as nickel-silver, copper-nickel, nickel-chromium, and ferro-nickel.



Steel Frame Lift Truck Platform

Skid Platform

A steel frame skid platform for use with hand operated lift trucks was recently placed on the market by Lewis-Shepard Co., Boston, Mass.

This new platform, which is shown in the accompanying illustration has, according to the manufacturer, advantages as follows: The clearance from the underside of the platform to the floor is the same on both sides and end, permitting the truck to be backed in either way and thus making the platform more flexible in use. The platform is steel bound all around, all the boards being protected by this steel binding, in particular the end boards, the life of the platform thus being much prolonged. The steel frame is a unit and does not depend upon the clamping of the steel frame and sheet to the wooden top for strength or rigidity. The metal parts are fabricated by welding and are thus the equivalent of one solid piece, which results in additional strength and precludes the possibility of any loose bolts or rivets. The top of the platform is flat, the steel and board being flush, and there being no bolt heads or rivet heads to protrude.

Steel Switchboards

A simple construction of steel switchboard panel, with several outstanding advantages, can now be furnished by the General Electric Co., Schenectady, N. Y. The construction is such that the new board partakes of the conventional switchboard features to an extent that makes it possible even to install the new and old types together, temporarily or permanently. Combinations of steel and slate or ebony asbestos panels on one board will be practicable.

Pipe supports are retained on the steel panels. Each panel can be shipped completely wired without unusual care and bracing in packing. In erecting the board, the framework is set up first, and the individual panels are then installed one by one. The panel wiring is grouped in trough-shaped recesses at the sides.

When installing slate or ebony asbestos panels adjacent to the new steel design, the so-called angle-pipe construction of support is used; i.e., the former are mounted on light angles placed $\frac{1}{4}$ of an inch inside the edges of the panels. These angles serve to support the several sections of the panels, and the wiring during shipment. The dimensions of the steel panels with their supporting edges are the same as those of corresponding slate or ebony asbestos panels with supporting angles. The rounded edge of the steel panel matches the rounded edge on the next steel panel, or the $\frac{3}{4}$- or $\frac{3}{8}$-in. bevel on the adjacent old panel.

The new panels are made in standard widths of 16, 20, 24, 28 and 32 inches, with a standard height of 90 inches.

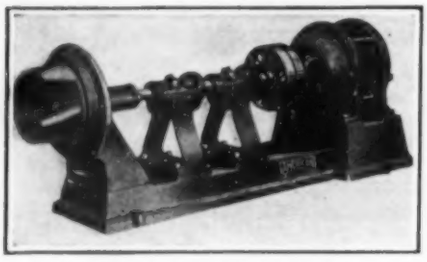
Limit Switch

The Electric Controller & Mfg. Co., Cleveland, Ohio, announce that a new rotating cam limit switch to be used with a magnetic controller for the automatic control of machines having such fixed sequences of operation as slowing down, stopping and reversing. This switch is totally inclosed, is equipped with tapered roller bearings and is designed to carry as many as six sets of contacts. The cams which operate the opening and closing of the contacts are each adjusted independently of the others and can be fixed at any desired position thus allowing much flexibility in the control of the machine.

Boiler Gage Light

The Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., has designed and is now manufacturing a new boiler gage light consisting of a tubular reflector with a bayonet attachment to the socket flange. In this light a compression spring serves to maintain the connection and to hold the lamp in place, so that neither the reflector nor the lamp can loosen under vibration.

The design of this light permits mounting on the guard rail of any boiler water gage, or on the end of a $\frac{1}{2}$-in. conduit used to carry wiring to the reflector. This mounting may be accomplished by the use of a screwdriver. In changing the lamp, one turn of the reflector serves to disengage the bayonet attachment, and the lamp can then be screwed out of the socket. The reflector is made of heavy brass tubing with a slot in one side so that the light is thrown upon the water gage only. It can be adjusted for any desired mounting height, and the mounting brackets are arranged to accommodate a wide range of conditions of the guard rods with relation to the gage. Forty-eight inches of conductor cord and an attachment plug are furnished with this light. The lamp used is a standard tubular Mazda B lamp with T-10 bulb.



Non-Clogging Centrifugal Pump

Non-Clogging Pump

For pumping fluid containing mineral matter, animal matter and vegetable matter such as hair, string, waste, shavings, rags, chips, sand, sludge, wire and various kinds of refuse, the American Well Works, Aurora, Ill., has recently brought out a non-clogging centrifugal pump.

This pump, which is shown in the accompanying illustration, does away with the necessity for using screens and the nuisance of maintaining them. The single blade impeller in the pump is designed so that the stream lines are not separated, the stream of fluid being kept in one mass and carried through without being broken up. By compelling all of the liquid and solid matter to be discharged through a single passage, there is no possibility of the different portions of a single piece of solid matter being swept into different outlet passages.

This pump is made in both vertical and horizontal types and in various sizes.

Arc Welder

A new automatic arc welder, called the "Duo-Arc," has recently been placed on the market by the General Electric Co., Schenectady, N. Y. This machine, which is said to weld automatically at approximately ten times the speed that can be obtained with the single arc manually controlled process, consists of a standard travel carriage on which are mounted two automatic welding heads and two reels of electrode wire. With this equipment, the manufacturers claim that the operation is just as simple as that of the single arc travel carriages. One attendant can supervise the two arcs as easily as he can one arc.

This new welder is particularly recommended by the manufacturers for use in butt welding heavy plates. This is accomplished by two electrodes working one behind the other simultaneously. Thus the necessarily large quantity of metal required to fill up the seam is deposited in practically one-half the amount of time which would be required for the travel of one electrode.

For welding ½ in. plates, the seam is prepared by beveling to an angle of 30 deg. total opening. With ⅛ in. electrodes and approximately 250 to 300 amperes in the arc, a speed of welding of from 5 to 7 in. per minute may be obtained. Thus the speed of welding is approximately ten times that obtained with a single arc manually controlled and the resulting weld is claimed to be of better quality because of the decreased chance of burning.

Centrifugal Pump

A new series of high speed, high head single stage centrifugal pumps called the class "SF," has recently been introduced by the Buffalo Steam Pump Co., Buffalo, N. Y.

In this pump the casing is of the double suction horizontally divided type. The impeller is of a special bronze, finished all over and balanced. There are bronze clearance rings in the casing and bronze wearing rings on the impeller. The bearings are of the ring oiling type with split bronze bearing shells and two ball thrust bearings are provided, of adjustable design. The stuffing boxes are bronze lined.

These pumps are designed for heads as high as 500 ft. and will operate at speeds up to 3,600 r.p.m.

Oil Well Compressor

The Chicago Penumatic Tool Co., 6 East 44th St., New York, N. Y., is now marketing a line of vertical, four cycle, gas-engine-driven air compressors of standard air pressure for commercial purposes and high pressure two stage compression for use in the flowing of oil wells. These two types are designated as V-CTG and V-CTGZ. The latter machine is that especially designed for use in flowing oil wells.

This oil well compressor uses the design of the Motoren Werke Manheim Benz engine in all its details with the substitution of gas heads and ignition system in place of the standard Diesel heads. But if at any time a supply of gas should not be available, Diesel heads can be substituted and the unit can be used as a solid injection Diesel engine.

The compressor is of the standard Chicago pneumatic type embodying the "simplate" valve.

Electric Motors

A new type of induction motor which, with its control, is even simpler to operate than the ordinary squirrel cage motor and compensator, has been placed on the market by the General Electric Co., Schenectady, N. Y. A complete line of these motors bearing the type designation FT and ranging in rating from 7½ to 50 hp. has now been made available.

This motor is in general suitable for application wherever the ordinary squirrel cage induction motor with compensator has been used. It is designed to start on full voltage giving a slightly higher starting torque but approximately the same starting current as the ordinary induction motor started with a compensator connected to the 80 per cent tap.

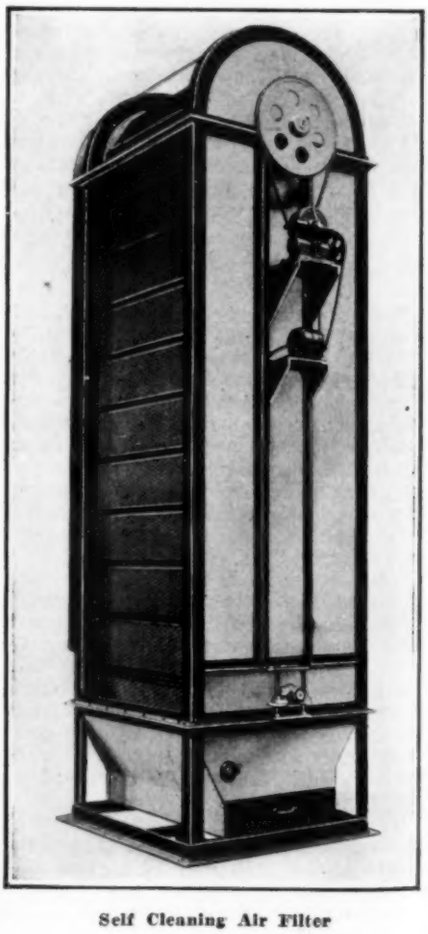
In appearance these motors are the same as other induction motors. Rotors are of cast aluminum with bars so shaped and located in the punchings as to give a high reactance effect on starting. Starting current is within the N.E.L.A. limitation up to and including the 30 hp. size.

Control apparatus required is very simple. An ordinary line switch of proper capacity can be used, but in order to obtain proper overload and under voltage protection, the motors are recommended for use with magnetic starting switches using push button control. Where necessary on the larger sizes, a compensator or resistor starter may be used as in the case of the ordinary induction motor.

The advantages claimed for these new motors are low cost, simplicity, reliabilty, low starting current permitting the use of a line switch, elimination of the possibility of abuse by inexperienced operators and ready adaptation to automatic control of various types.

Air Filter

Midwest Air Filters, Inc., Bradford, Pa., has recently developed a self-cleaning filter for use in supplying clean air for heat and ventilating systems, driers and other similar equipment. This filter, shown in the accompanying illustration, consists of a chain made up of filtering elements, enclosed in a sheet metal housing. The chain is driven by an electric motor through a reducing gear and moves about 6 in. per minute. The filter elements on the chain are demountable and can be replaced when necessary. The bottom of the housing forms a reservoir in which the cell cleaning fluid is placed and below this is a sediment drawer from which the dirt may be periodically removed. Connections are provided for drawing off the cleaning oil from the reservoir. Clean oil and dirty oil are withdrawn separately.



Self Cleaning Air Filter

Oil Leaks

A paint which is said to be the only material that effectively seals joints against oil leaks has been developed by the General Electric Co., Schenectady, N. Y., and is sold by the Merchandise Department at Bridgeport, Conn. The product, known as G-E No. 880 Red Protective Paint, also prevents water and gas leaks. It can be used for many purposes which require red lead or white lead, and is less expensive than either.

The paint, which is dark red in color, requires no priming and can be applied by brushing or dipping. Denatured alcohol is used as a thinner. It dries rapidly and produces a hard, smooth, glossy film which is easily cleaned and which prevents excessive collection of dirt and conducting material, thereby decreasing surface leakage and subsequent carbonization of the surface when used with electrical apparatus.

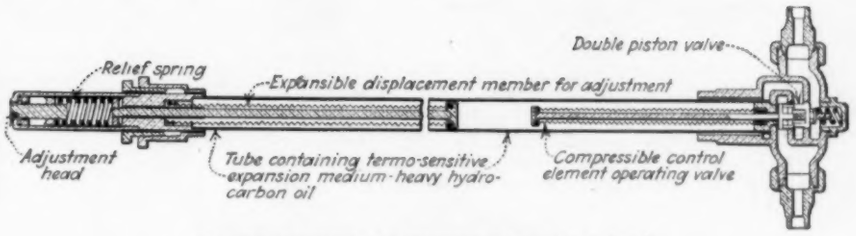
One of the first fields in which the paint has been applied is in the manufacture of fuel oil burners, in which one company is now using the material to seal all joints. Other fields in which there will be applications for the paint include plumbing, chemical plants, repair and service shops, packing houses, ship yards, central stations, electric railways, mines, and the manufacture of oil tanks, oil-burning locomotives and similar equipment.

Time-Delay Attachment

A new time-delay attachment, announced by the General Electric Co., Schenectady, N. Y. is designed for use with hand starting compensators to provide undervoltage protection during brief disturbances in industrial power circuits. Many establishments, utilizing a large number of motors, run separate circuits to energize the undervoltage coils of the starter, this circuit being furnished by a motor generator running on its own momentum for some time after the failure of power. The new attachment was developed to meet the demand for a time-delay undervoltage release, resulting from the larger number of potential dips caused by the increased use of such power systems, and the wider use of undervoltage protection on motor starters.

The attachment bears the designation CR-2820-1062. It can readily be mounted on a hand starting compensator in the same supporting holes as used for the standard undervoltage release.

Time delay is accomplished by a falling solenoid plunger whose downward movement is retarded by a flywheel. A rack, which turns the flywheel by means of a pinion on its shaft, is fastened to the solenoid plunger. On the downward movement of the plunger, the flywheel is caused to revolve but the parts are so designed that the upward movement of the plunger disengages the teeth of the rack from the pinion, permitting an instantaneous movement. The time delay is about 1½ seconds and if power returns in less than that time the starting compensator is not tripped.



Special Temperature Regulator For Chill Bath

Chill Bath for Glue and Gelatin Testing

The Sarco Co., Inc., New York, N. Y., has recently developed a temperature regulated chill bath for use in the testing of glue and gelatine samples. The design for this bath originated with Mr. F. S. Williams of Baugh & Sons Co., and has been remodeled under the supervision of Dr. J. R. Powell, chief chemist of the Armour Glue Works.

This type of apparatus is now being used by many of the principal manufacturers of the country. In the testing of animal glues and gelatins, three distinct operations are necessary to determine the jelly strength and viscosity, which tests largely determine the value of the products. The standard methods for testing adopted by the National Association of Glue Manufacturers include the use of a chilling apparatus or bath for maintaining constant temperatures of samples for a period preceding testing. Solutions of the glues to be tested are placed in the bath and a uniform temperature maintained for some time. This operation is of importance as even slight variations in the temperatures affect the jell structure and result in inaccurate tests. After the samples have been chilled they are tested for strength by a jelometer and for viscosity by a viscosimeter.

The Sarco chill bath is a cabinet about 5 ft. high and 2 ft. 6 in. square divided into 2 chambers. The lower chamber is copper lined and is arranged to accommodate 200 lb. of ice or if a refrigeration system is available to accommodate cooling coils in which brine circulates. The upper chamber is fitted with a water-circulating system in which water is kept constantly in movement by means of an electrically-driven motor pump. The upper chamber is also copper lined and is provided with space to take a number of small glasses containing samples of glue or gelatin. The water, in constant circulation around these glasses maintains them at a predetermined temperature. If this temperature tends to rise, a special Sarco temperature regulator, the element of which is submerged in the water, operates a circulating line from the lower refrigeration chamber admitting just as much of the cooler water as is necessary to maintain the temperature at a constant point. The accuracy is claimed to be such that temperature in the test chamber is maintained correctly within a fraction of 1 deg. C.

On an extended test of one hundred hours on one of these baths there was no change in the temperature setting of 10 deg. C. greater than $\frac{1}{10}$ of 1 deg. C., plus or minus. Such accuracy of control is guaranteed with this regulator.

The temperature regulator used, shown in the accompanying diagram, consists of a closed tube containing a heavy hydrocarbon oil which is sensitive to temperature changes. As the temperature increases the oil expands and operates a valve. An adjusting device is provided in the shape of a head by means of which the capacity in the regulator can be varied, thus giving the temperature sensitive medium more or less space in which to expand.

Vibrating Screen

Link Belt Co., 910 S. Michigan Ave., Chicago, Ill., has recently placed on the market a new design of vibrating screen.

In this screen the vibration is caused by the rotation of a shaft thrown out of balance by the use of adjustable counterweights, thus imparting vibration to the screen box upon which it is mounted. These vibrations are transmitted to the screen cloth which is secured under tension in the box. The vibrating shaft is provided with oversize ball bearings.

There are five standard sizes of this screen as follows: 2x5 ft., 3x5 ft., 4x5 ft., 3x8 ft., and 4x8 ft. These screens are furnished with either one or two screen surfaces. A feed hopper attached to the receiving end of the screen box vibrates with it and thus controls the feed which is spread uniformly over the screening surface. For screening materials containing small particles, the hopper is fitted with a counterweighted swinging feed gate.

Air Filter

A new design of air filter has been brought out recently by the American Blower Co., Detroit, Mich. The filter is of the dry plate design, so arranged that the air is divided into a series of small jets. In this way it is caused to strike against the surfaces of the plates which are provided with many fine filaments or tentacles which serve to arrest and retain the dust and the dirt. The air, after hitting the first plate, is caused to change its direction and then strike against another plate. There are ten successive dust removal operations of this type.

As dust fills up on the surface of the plate, each preceding layer acts as a retentive member, the dust itself being the principal dust arresting and retaining factor for the ensuing particles of dust and air. In this way the use of adhesive is avoided and the maximum load of the cleaner or filter is multiplied many times.

Safety Connector

The Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has recently developed a new clip-type safety connector for use where a well insulated safety connector is desired, which eliminates the possibility of accidentally or carelessly "kicking" out the connector plug. In this connector the safety feature is accomplished by means of a lever operated, movable plunger, which is forced into a groove in the slot, holding it securely. The connector plug cannot be removed until the plunger is released by pulling up the lever.

This connector may be designed for switchboard mounting by merely adding two studs. The connector itself consists of a casing of molded insulation containing a brass tube at each end. The permanent conductor is fastened and clamped by means of two setscrews into one end of the brass conducting sleeve of the connector and the temporary conductor is inserted into the other end and held fastened as explained above.

Melting Pot

Harold E. Trent Co., Philadelphia, Pa., has recently added a new melting pot to their line of electrically heated pots for melting solder, lead, babbitt, tin and other metals. This new pot is of 100 lb. capacity when used with lead. A cast terminal box with an outlet in the bottom is provided for use with a BX connection or rigid metal conduit. The terminals are placed horizontally from the side walls of the casting, in order to facilitate connection and inspection.

Another feature of this pot is portability, and when required, semi-rigid eye bolts secured on the rim of the casting are supplied. These eye bolts can be used on connection with crane hooks when pouring direct from the pot.

The crucible is of a special cast iron and is designed to stand the strain incident to heating and cooling of a considerable mass of metal. The casing is of sheet steel with welded seams reinforced with steel bands. This pot is recommended for operation with a temperature control. It can be used if desired for melting salts that require a temperature less than 1,000 deg. F.

Motor Base

A tension motor base that has been used for some time in Europe has recently been introduced into the United States by Tension Motor Base Co., 15 East 26th Street, New York, N. Y. This device consists of a movable platform upon which the motor is mounted, supported on each corner by steel springs, whose tension is adjusted to suit the operating conditions. To the center of this platform is fastened a rack passing downward to engage a pinion mounted on the base of the main frame. On the outer end of the pinion shaft is mounted a lever carrying an adjustable counterweight by means of which the motor fastened on the platform may be easily counterbalanced. The action of this lever and counterweight on the belt procures by virtue of the springs a constantly uniform tension of the belt under all conditions. This tension may be changed or adjusted at any time.

Throwing the lever and counterweight to the opposite side disengages the motor. The motor may be started without load and when up to speed the load gradually applied by means of this lever and counterweight. It is claimed that this base is particularly advantageous for vertical drive.

Manufacturers' Latest Publications

General Carbon Co., 17 West 46th St., New York City—A folder describing the use of carbon dioxide as a fire extinguisher with special reference to the Type A, B and C portable extinguishers.

Newark Wire Cloth Co., 351 Verona Ave., Newark, N. J.—Catalog No. 26—New general catalog of the woven wire cloth made by this company.

Webster Mfg. Co., Chicago, Ill.—Two new leaflets, one being a revised price list for screw conveyor sectional flights, and the other dealing with adjustable bag holders.

Niagara Blower Co., Buffalo, N. Y.—A leaflet dealing with unit type cloth screen dust collectors.

Kansas City Oxygen Gas Co., Kansas City, Mo.—A new booklet entitled "A Few Suggestions on the Proper Operation of Gas Cylinders, Valves and Pressure Reducing Regulators."

Homestead Valve Mfg. Co., Homestead, Pa.—A folder describing the Homestead-Ross shut-off valve.

Stone & Tar Products Co., Inc., 97 South 6th St., Brooklyn, N. Y.—A booklet describing patented materials for structural repairs and plant maintenance.

Smith Welding Equipment Corp., Minneapolis, Minn.—A pocket size general catalog of oxy-acetylene welding and cutting equipment.

The Foxboro Co., Inc., Foxboro, Mass.—A folder describing various types of recording gages.

Sullivan Machinery Co., 122 South Michigan Ave., Chicago, Ill.—Bulletin Nos. 76-G and 81-I—The first of these bulletins describes single and double drum electric portable hoists and the second catalog describes "busters" for breaking concrete.

Robinson Mfg., Muncy, Pa.—Bulletin No. 32-A—A new general catalog of all sizes of mixing machinery of the various types made by the company, including both batch and continuous designs.

Bethlehem Foundry & Machine Co., Bethlehem, Pa.—Bulletin H-400—A catalog showing various designs of equipment made from "Tantiron," an acid and alkali resistant metal.

New Departure Mfg. Co., Bristol, Conn.—Bulletin No. 177-FE—A bulletin describing the application of ball bearings to flexible shaft grinders.

General Electric Co., Schenectady, N. Y.—Several new bulletins as follows: G.E.A.-574, bulletin on automatic switching equipment; G.E.A.-586, bulletin on automatic arc welding; G.E.A.-588, bulletin on geared speed changing units for use with centrifugal compressors; G.E.A.-594, a bulletin on automatic control panels for industrial electric heating; G.E.A.-708, a bulletin describing medium speed synchronous motors of the "7600 series."

American Rolling Mill Co., Middletown, Ohio.—A publication giving a brief historical sketch of this company from its founding to the present day illustrated with exterior and interior views of the various plants.

Fisher Scientific Co., Pittsburgh, Pa.—Catalog of the 1927 spring clearance sale of laboratory supplies and equipment.

Cambridge Instrument Co., Ltd., 45 Grosvenor Place, London, England.—A folder describing dial thermometers.

Cleveland Crane & Engineering Co., Wickliffe, Ohio.—A folder showing illustrations of the use of the Cleveland Tramrail System in material handling work in various industries.

Jeffrey Mfg. Co., Columbus, Ohio.—Catalog No. 437.—A catalog of material handling equipment for handling stone, gravel, sand, cement, gypsum, lime, slag and similar materials.

International Nickel Co., 67 Wall Street, New York, N. Y.—A booklet entitled "One Hundred Years of Steel Improvement" containing a series of preprints of advertisements dealing with this historical aspect of alloy steel.

U. S. Electrical Mfg. Co., Los Angeles, Calif.—Two new leaflets describing a new application of asbestos protection to the insulation of motors.

Schwartz Sectional System, Indianapolis, Ind.—A catalog describing the Schwartz system of cabinets for storing laboratory supplies and apparatus.

Barnstead Still & Sterilizer Co., Inc., Boston, Mass.—Catalog A—New general catalog of water distilling apparatus for all purposes.

Acme Electric Heating Co., Boston, Mass.—Catalog C—A complete catalog of electric heating and resistor equipment made by this company.

W. H. Nicholson & Co., Wilkes-Barre, Pa.—Bulletin No. 227—A bulletin describing devices for removing moisture, oil and dirt from compressed air.

Krogh Pump & Machinery Co., San Francisco, Calif.—Bulletin No. 98—A bulletin describing a new design of fully lined pumps for handling sand and tailings.

Parks-Cramer Co., Boston, Mass.—A leaflet describing the use of the Merrill system of process heating in the vegetable oil industry.

New Jersey Zinc Co., 160 Front St., New York, N. Y.—A new and complete catalog illustrating the use of zinc roofing and siding for industrial buildings.

American Refractories Institute, Pittsburgh, Pa.—A chart showing the utility of refractories.

E. Leitz, Inc., 60 East 10th Street, New York, N. Y.—Bulletins Nos. 1067 and 1069—Two new bulletins covering various types of microscopes.

General Refractories Co., Philadelphia, Pa.—A folder describing Arcofrax High Alumina Brick as used in cement kilns.

Hardinge Co., New York, Pa.—Bulletin No. 25—A catalog describing the design and use of conical rod mills.

Worthington Pump & Machinery Corp., 115 Broadway, New York, N. Y.—Bulletin H. O. 1900—A catalog entitled "Equipment for Power Plants" which describes steam condensers, pumps, air compressors, Diesel engines, gas engines, and oil and water meters.

Brown Instrument Co., Philadelphia, Pa.—Catalog No. 33—A new catalog on the design and use of the electric CO_2 meter made by this concern.

Hardinge Company, York, Pa.—Bulletin No. 30—A bulletin describing the Hardinge super-thickener and clarifier.

United Filters Corporation, Hazleton, Pa.—Bulletin No. 150—A catalog of the Sweetland cantilever filter.

Automatic & Electric Furnaces, Ltd., 173 Farringdon Road, London, England—A catalog of Wild-Barfield small electric furnaces for laboratory and other purposes.

Riley Power Equipment Co., Milwaukee, Wis.—A leaflet describing the Eckenroth Automatic Reseating Blowoff Valve.

North American Cement Corp., Albany, N. Y.—Booklet describing "Cal" for use in portland cement mixtures to obtain high early strength, to improve curing, for densifying, for easy workability, as a hardener, and for placing in cold weather.

Multi-Metal Co., 799 East 139th Street, New York, N. Y.—A new general catalog of the wire cloth screens from 4 to 325 mesh made of various metals, as produced by this company.

Nashville Industrial Corporation, Old Hickory, Tenn.—Bulletin No. 28—A bulletin describing second-hand hot water heaters for sale by this company.

Roller-Smith Co., 233 Broadway, New York, N. Y.—Bulletins No. 550 and No. 100—Supplement No. 1—The first of these describes type FR relays, and the second describes electrical instruments for signal-system testing.

The Carborundum Company, Niagara Falls, N. Y.—Bulletin E-11—A bulletin describing the Carbofrax recuperator, built under the Fitch patent, for use with industrial furnaces.

Crouse-Hinds Company, Syracuse, N. Y.—Catalog 2100 and Folder 50—These two new publications describe a new type of conduit called the "Obround" for which is claimed advantages over older types.

Connersville Blower Company, Connersville, Ind.—Bulletins 21C and 22—The first of these bulletins describes Victor rotary positive blowers and the second describes leather-link flexible couplings.

H. H. Robertson Company, Pittsburgh, Pa.—A folder describing the use of Robertson ventilators for industrial buildings.

United Rock Asphalt Company, Louisville, Ky.—A bulletin describing the use of rock asphalt for paving purposes.

Patents Issued April 5 to May 3, 1927

Paper, Pulp and Sugar

Pulp Grinder. Johan Daniel Ullgreen, Stocksund, Sweden, assignor to Aktiebolaget Karlstads Mekaniska Verkstad, Karlstad, Sweden.—1,626,015.

Process of Utilizing Old Paper Stock. Joseph E. Plumstead, Wilmington, Del., assignor to The Jessup & Moore Paper Co., Philadelphia, Pa.—1,625,279.

Paper Manufacture. Arthur D. Little, Brookline, and Carroll E. Carpenter, Melrose, Mass., assignors to Arthur D. Little, Inc., Boston, Mass.—1,624,492.

Mottling Device for Paper Making. Harry M. Ross, Indianapolis, Ind., assignor of one-half to Beveridge Paper Company, Indianapolis, Ind.—1,624,184.

Process and Mechanism for Making Crinkled Paper. Nicholas M. Goodlett, New York, N. Y., assignor to Arkell Safety Bag Company, New York, N. Y.—1,626,527.

Coated Paper Board. Charles C. Colbert and George E. Preston, Elkhart, Ind., assignors to American Coating Mills, Elkhart, Ind.—1,624,091.

Manufacture of Fiber Board. Robert W. Hilton, deceased, late of Cincinnati, Ohio, by Danesi M. Milton, executrix, Cincinnati, Ohio, assignor to The Kemper-Thomas Company, Norwood, Ohio.—1,624,599.

Bagasse Board and Method of Making the Same. Charles W. Mason, Olaa, Territory of Hawaii.—1,627,103.

Process of Manufacturing Insulating and Plaster Board from Cornstalks. James J. Hinde, Sandusky, Ohio.—1,623,184.

Manufacture of Strawboard. Mary E. Pennington, St. Davids, Pa., and Alex Brooking Davis, Cincinnati, Ohio.—1,625,090.

Rubber and Synthetic Plastics

Vulcanization Accelerator and Process of Making Same. Harold Walter Elley and Donald Howard Powers, Wilmington, Del., assignors to E. I. du Pont de Nemours & Company, Wilmington, Del.—1,624,723.

Vulcanization. Daniel E. Hennessy, Milwaukee, Wis., assignor to The Fisk Rubber Company, Chicopee Falls, Mass.—1,623,183.

Rubber-Deterioration Retarder and Process of Making. Sidney M. Cadwell, Leonia, N. J., assignor to The Naugatuck Chemical Company.—1,626,784.

Machine for Mixing or Masticating Rubber and Like Material. David R. Bowen, Ansonia, and Carl F. Schnuck, New Haven, Conn., assignors to Farrel Foundry & Machine Company, Ansonia, Conn.—1,623,159.

Process of Reclaiming Rubber. Marcus J. Fessler, Syracuse, N. Y.—1,626,800.

Rubber Composition and Method of Preparing Same. Harold Walter Elley, Wilmington, Del., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del.—1,624,724.

Resin and Process of Making the Same. Charles O. Terwilliger, Beacon, N. Y., assignor to Fritz V. Briesen, trustee, New York, N. Y.—1,624,638.

Stabilization of Plastic. Charles E. Burke, Wilmington, Del., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del.—1,626,916.

Process for the Manufacture of Linoxin-like Substances. Willy O. Herrmann and Hans Deutsch, Munich, Germany, assignors to Consortium für Elecktrochemische Industrie, Munich, Germany.—1,625,852.

Resins and Process of Making the Same. Charles O. Terwilliger, Beacon, N. Y., assignor to Fritz V. Briesen, trustee, New York, N. Y.—1,624,082.

Process for Manufacturing Homogeneous Glasslike Condensation Products of Urea and Formaldehyde. Kurt Ripper, Vienna, Austria, assignor to Fritz Pollak, Vienna, Austria.—1,625,283.

Method for the Improvement of Natural Resins. August Amann and Ewald Fonrobert, Wiesbaden, Germany, assignors to the Firm Chemische Fabriken Dr. Kurt Albert G. m. b. H., Amoneburg, near Biebrich-on-the-Rhine, Germany. — 1,623,901.

Method of Treating Moldings of Partially-Cured Phenolic Condensation Product. Franklin S. Smith, Brooklyn, N. Y., assignor to The Products Protection Corporation, New York, N. Y.—1,627,209.

Petroleum Refining

Distillation Apparatus. Warren K. Lewis, Newton, Mass., assignor to Standard Development Company.—1,626,346.

Art of Distilling Hydrocarbon Material. Edgar M. Clark, New York, N. Y., assignor to Standard Development Company.—1,625,984.

Oil Still. John E. Bell, Brooklyn, N. Y., assignor to Sinclair Refining Company, Chicago, Ill.—1,623,773.

Distilling Apparatus. James H. Burlingham, Port Arthur, Tex., assignor to The Texas Company, New York, N. Y.—1,626,223.

Apparatus for Distilling Hydrocarbons Under Pressure and a Catalyzing Agent. Francis M. Hess, Whiting, Ind.—1,625,467.

Distillation of Tar and the Like. William Brown Davidson, Arthur Cumming Michie, and Ernest Walter Muddiman, Newcastle-on-Tyne, England.—1,626,588.

Apparatus for Treating Oils. Gustav Egloff, Chicago, Ill., and William R. Howard, Washington, D. C., assignors to Universal Oil Products Company, Chicago, Ill.—1,627,164.

Process and Apparatus for Converting Petroleum Hydrocarbons. Roy Cross, Kansas City, Mo., assignor to Gasoline Products Company, New York, N. Y.—1,624,778.

Treating Hydrocarbons. Otis G. Messenger, Elizabeth, N. J., assignor to Standard Development Company.—1,623,061.

Process and Apparatus for Treating Hydrocarbon. William R. Howard, Washington, D. C., assignor to Universal Oil Products Company, Chicago, Ill.—1,627,436.

Method of Treating Hydrocarbons. Walter M. Cross, Kansas City, Mo., assignor, by mesne assignments, to Gasoline Products Company.—1,624,889.

Process and Apparatus of Dephlegmation. Jean D. Seguy, Chicago, Ill., assignor to Universal Oil Products Company, Chicago, Ill.—1,623,136.

Process of and Apparatus for Condensing, Treating, and Washing Hydrocarbon Vapors. Claude Leslie Freeland, Bristow, Okla.—1,627,431.

Method for Treating Petroleum and Other Hydrocarbons. Carbon P. Dubbs, Wilmette, Ill., assignor to Universal Oil Products Company, Chicago, Ill.—1,627,159.

Method of Purifying Hydrocarbon Oils. Jacque C. Morrell and Saimen Comay, Chicago, Ill., assignors to Universal Oil Products Company, Chicago, Ill.—1,627,055.

Condensation of Hydrocarbons. Edward W. Isom, Winnetka, Ill., and John E. Bell, Brooklyn, N. Y., assignors to Sinclair Refining Company, Chicago, Ill.—1,623,790.

Process of Extracting Hydrocarbons from Gas. August P. Bjerregaard, Okmulgee, Okla., assignor to Doherty Research Company, New York, N. Y.—1,624,206.

Treatment of Oils. Walter O. Snelling, Allentown, Pa., assignor to Gasoline Products Company, Inc., New York, N. Y.—1,624,848.

Process for Treating Oil Shale. Gustav Egloff, Chicago, Ill., assignor to Universal Oil Products Company, Chicago, Ill.—1,627,162.

Process of Manufacturing Gasoline. Henry Thomas, Ridley Park, Pa., assignor to Sun Oil Company, Philadelphia, Pa.—1,624,692.

Process of Treating Oil Shale. Gustav Egloff, Chicago, Ill., assignor to Universal Oil Products Company, Chicago, Ill.—1,627,163.

Condensing Apparatus. Alfred Otto Hermann Petersen, Altona/Elbe, Germany, assignor to N. V. Nederlandsche Installatie Naatschappij Therma, Amsterdam, Netherlands.—1,624,066.

Process of Obtaining Resinlike Bodies from Cracked Hydrocarbon Products. Jacque C. Morrell and Gustav Egloff, Chicago, Ill., assignors to Universal Oil Products Company, Chicago, Ill.—1,627,054.

Carbon-Removing Mechanism for Stills. James M. Wadsworth, Fort Worth, Tex.—1,624,083.

Emulsion and Process of Making the Same. Dozier Finley, Berkeley, Calif., assignor to The Paraffine Companies, Inc., San Francisco, Calif.—1,625,304.

Organic Processes

Catalyst for Synthetic-Methanol Production. John C. Woodruff and Grover Bloomfield, Terre Haute, Ind., assignors to Commercial Solvents Corporation, Terre Haute, Ind.—1,625,924.

Catalyst for Synthetic-Methanol Production. John C. Woodruff and Grover Bloomfield, Terre Haute, Ind., assignors to Commercial Solvents Corporation, Terre Haute, Ind.—1,625,926.

Catalyst for Synthetic-Methanol Production. John C. Woodruff and Grover Bloomfield, Terre Haute, Ind., assignors to Commercial Solvents Corporation, Terre Haute, Ind.—1,625,927.

Catalyst for Synthetic-Methanol Production. John C. Woodruff and Grover Bloomfield, Terre Haute, Ind., assignors to Commercial Solvents Corporation, Terre Haute, Ind.—1,625,928.

Catalyst for Synthetic-Methanol Production. John C. Woodruff and Grover Bloomfield, Terre Haute, Ind., assignors to Commercial Solvents Corporation, Terre Haute, Ind.—1,625,929.

Carbon Catalyst and Process of Making It. Charles B. Jacobs, Wilmington, Del., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del.—1,623,598.

Intermediate Product for the Synthesis of Azo Dyes and Process of Making Same. Hermann Fritzsche, Eduard Krummenacher, Hans Gubler, and Otto Kaiser, Basel, Switzerland, assignors to Society of Chemical Industry in Basle, Basel, Switzerland.—1,625,531.

Azo Dyestuffs from Aminodiphenylenoxide. Eugen Glietenberg, Leverkusen, Germany, assignor to Grasselli Ryestuff Corporation, New York, N. Y.—1,624,944.

Dyestuffs and Process of Making Same. Fritz Straub, Basel, and Hermann Schneider, Riehen, near Basel, Switzerland, assignors to Society of Chemical Industry in Basle, Basel, Switzerland.—1,624,637.

Intermediate Product for the Synthesis of Azo Dyes and Process for Making Same. Hermann Fritzsche, Eduard Krummenacher, Hans Gubler, and Otto Kaiser, Basel, Switzerland, assignors to Society of Chemical Industry in Basle, Basel, Switzerland.—1,625,533.

Intermediate Product for the Synthesis of Dyes and Process of Making Same. Hermann Fritzsche, Eduard Krummenacher, Hans Gubler, and Otto Kaiser, Basel, Switzerland, assignors to Society of Chemical Industry in Basle, Basel, Switzerland. —1,625,530.

Green Blue to Green Vat Dyestuffs of the Thioindigo Series. Richard Herz, Frankfort-on-the-Main, and Jens Müller, Hanau-on-the-Main, Germany, assignors to Grasselli Dyestuffs Corporation, New York, N. Y.—1,623,410.

Process of Making Intermediate Products for the Manufacture of Azo Dyes. Hermann Fritzsche, Eduard Krummenacher, Hans Gubler, and Otto Kaiser, Basel, Switzerland, assignors to Society of Chemical Industry in Basle, Basel, Switzerland. —1,625,532.

Manufacture of Vat Dyestuffs, Maximilian Paul Schmidt, Biebrich-on-the-Rhine, Germany, assignor, by mesne assignments, to Grasselli Dyestuff Corporation, New York, N. Y.—1,625,826.

Process of Producing Lactic Acid from Sugar-Containing Raw Materials By Means of Lactic-Acid Bacteria. Alfred Pollak, Vienna, Austria.—1,624,674.

Ethyl - Normal - Hexyl - Barbituric Acid. Arthur W. Dox, Windsor, Ontario, Canada, assignor to Parke Davis & Company, Detroit, Mich.—1,624,546.

Process for Producing 1.8-Hydroxynaphthoic Acid. Richard Herz and Fritz Schulte, Frankfort-on-the-Main, Germany, assignors to Grasselli Dyestuff Corporation, New York, N. Y.—1,623,678.

Making Keto and Aldo Aliphatic Carboxylic Acids. Alfred Häussler, Niederingelheim-on-the-Rhine, Germany, assignor to C. H. Boehringer Sohn Chemische Fabrik, Niederingelheim-on-the-Rhine, Germany.—1,627,091.

Manufacture of Butyric Acids and Other Aliphatic Acids. Louis Le Franc, Paris, France, assignor to Lefranc & Cie., Paris, France.—1,625,732.

Process for Making Fatty Acids from Hydrocarbons. Walter Cornelius Harry Pataky, The Hague, and Frederick Jan Nellensteijn, Delft, Netherlands.—1,627,452.

Method of Recovering Glycerin from Fermented-Molasses Mash. Samuel K. Varnes, Wilmington, Del., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del.—1,626,986.

Method of Recovering Glycerin from Fermented Molasses Mash and Apparatus Therefor. James W. Lawrie, Wilmington, Del., assignor to E. I. du Pont de Nemours & Co., Wilmington, Del.—1,627,040.

Process of Making Polyhydroxy Carbon Compounds. Harry Essex, Syracuse, N. Y., and Alger L. Ward, Upper Darby, Pa., assignors to E. I. du Pont de Nemours & Company, Wilmington, Del.—1,626,398.

Process for Preparing a Reaction Product of Acetaldehyde and Aniline. Sidney M. Cadwell, Leonia, N. J., assignor to The

Naugatuck Chemical Company, Naugatuck, Conn.—1,627,230.

Art of Making Bisalkyl-Xanthogens. Albert Rothmann, Heidelberg, and Helmut Stein, Mannheim, Germany, assignors to C. F. Boehringer & Soehne G. m. b. H., Mannheim-Waldhof, Germany.—1,626,558.

Manufacture of a Substitute for Turpentine. Leland L. Odom, Little Rock, Ark., assignor to M-O-R Products Company, Little Rock, Ark., a Copartnership consisting of C. C. Monger, L. L. Odom, and J. D. Reynolds.—1,625,622.

Oxidized Pine Oil for Pigments. John K. Speicher, Kenvil, N. J., assignor to Hercules Powder Company, Wilmington, Del. —1,626,362.

Process of Making Benzanthrone. Robert G. Caswell and Ellsworth G. Marshall, Wilmington, Del., assignors to E. I. du Pont du Nemours & Company, Wilmington, Del. —1,626,392.

Process of Manufacturing Lactose. Sherman C. Meredith, Burlingame, and Niels N. T. Nyborg, Modesto, Calif.—1,626,857.

Process of Making Guaiacol. Ivan Gubelmann, Henry J. Weiland, and Otto Stallmann, South Milwaukee, Wis., assignors to The Newport Company.—1,623,949.

O-O-Diacyl Derivatives of Diphenolisatine and Process for the Manufacture of Same. Ernst Preiswerk, Basel, Switzerland, assignor to The Hoffmann-La Roche Chemical Works, New York, N. Y.—1,624,675.

Method of Obtaining Colored Polymerized Styrol and its Homologues and Products Obtained Thereby. Iwan Ostromislensky, New York, N. Y., assignor to The Naugatuck Chemical Company, Naugatuck, Conn. —1,627,195.

Manufacture of Menthol. Karl Schöllkopf, Dusseldorf-Oberkassel, Germany, assignor to Rheinische Kampfer-Fabrik Gesellschaft mit beschränkter Haftung, Dusseldorf-Oberkassel, Germany. — 1,625,-771.

Process and Apparatus for Manufacturing Amorphous Carbon, etc. Joel W. MacDonald, Little Rock, Ark., assignor to Winfred L. Rucker, Los Angeles, Calif.— 1,626,418.

Process of Bleaching Cellulose Acetate. Richard Baybutt and Edward S. Farrow, Jr., Rochester, N. Y., assignors to Eastman Kodak Company, Rochester, N. Y.— 1,623,519.

Preservation of Oils. Ferdinand W. Nitardy, Brooklyn, N. Y., assignor to E. R. Squibb and Sons, New York, N. Y.— 1,624,358.

Fluorescent Oil and Process of Making Same. Leon Lilienfeld, Vienna, Austria.— 1,625,415.

Casein Glue. Alfred Carl Marwin, Chicago, Ill., assignor to Western Electric Company, Incorporated, New York, N. Y.— 1,625,483.

Inorganic Processes

Process of Preparing Alkali-Metal Cyanides. Robert W. Poindexter, Jr., Los Angeles, and Paul T. Dolley, Los Angeles County, Calif., assignors to California Cyanide Company, Incorporated, New York, N. Y.—1,624,147.

Process for the Production of Hydrocyanic Acid. Georg Bredig and Egon Elöd, Karlsruhe, Germany, assignors to the Firm of Rudolph Koepp & Co., Oestrich-on-the-Rhine, Germany.—1,627,144.

Process for the Manufacture of Hydrocyanic Acid. Otto Liebknecht, Frankfort-on-the-Main, Germany, assignor to The Roessler & Hasslacher Chemical Company, New York, N. Y.—1,626,848.

Calcium Arsenate Products and Process of Making the Same. William J. Llipfert, Timonium, Md., assignor to General Chemical Company, New York, N. Y.—1,626,942.

Process for Converting Hafnium and Zirconium Phosphates. Jan Hendrik de Boer, Eindhoven, Netherlands, assignor to N. V. Philips' Gloeilampenfabrieken, Eindhoven, Netherlands.—1,624,162.

Method of Producing Phosphate Fertilizer. Utley Wedge, Ardmore, Pa., assignor to I. P. Thomas & Son Company, Camden, N. J.—1,624,195.

Process of Producing Arsenic Compounds. Eugene R. Rushton, Madison, Wis. — 1,624,281.

Process for the Manufacture of Ammonium Nitrate. Henry Howard, Cleveland, Ohio, assignor to The Grasselli Chemical Company, Cleveland, Ohio.—1,625,807.

Manufacture of Nitric Acid. Carlo Toniolo, Milan, Italy.—1,623,606.

Limekiln and Method of Burning Lime. Arthur E. Truesdell, Pittsfield, Mass., assignor of one-half to Doherty Research Company, New York, N. Y.—1,627,215.

Cement and Lime Burning. George Edward Heyl, Westminster, London, England.—1,625,853.

Manufacture of Hydraulic Cement and the Like. Oscar Gerlach, La Salle, Ill.— 1,627,170.

Process of Manufacturing Slag Cement. Joseph G. Harding, Jackson, Ohio, assignor of one-half to William R. Casparis, Columbus, Ohio, and one-half to Samuel E. Stephenson, Jackson, Ohio.—1,627,237.

Process of Making Cement. Ludwig Kern, Baltimore, Md.—1,623,876.

Process of Making a Stable Hydrogen Peroxide. Arthur L. Halvorsen, Perth Amboy, N. J.—1,627,325.

INSECTICIDE COMPOSITION. Oscar F. Hedenburg and David S. Pratt, Pittsburgh, Pa., assignors to The Toledo Rex Spray Company, Toledo, Ohio.—1,627,389.

Process for Making an Insecticide. William C. Piver, Hillside, N. J.—1,626,872.

Method for the Preparation of Hydrogen Sulphide. Abraham Henwood, Cynwyd, Pa., assignor, by mesne assignments, to Raymond M. Garey. Willow Grove, Pa.— 1,623,942.

Metal - Iodide - Alkali - Iodide Compounds Suitable for Use in Therapeutics and Process for Manufacturing Them. Hans Truttwin, Vienna, Austria.—1,627,359.

Process for the Preparation of Lithium Carbonate. Hans Weidmann, Frankfort-on-the-Main, Germany, assignor, by mesne assignments, to Allied Process Corporation, New York, N. Y.—1,623,513.

Chemical Engineering Equipment and Processes

Pulverizing Machine. William K. Liggett, Columbus, Ohio, assignor to The Jeffrey Manufacturing Company, Columbus, Ohio.— 1,625,554.

Pulverizing Machine. William K. Liggett, Columbus, Ohio, assignor to The Jeffrey Manufacturing Company, Columbus, Ohio. —1,625,553.

Machine for Breaking Ore and Other Minerals. Ralph Hush, Johannesburg, Transvaal, South Africa.—1,626,535.

Apparatus and Process for Leaching, Filtering, and Absorbing Gases and the Like. Harold M. Stark, Highland Park, Mich.—1,625,831.

Process of Dewatering Peat. George A. Schroter, Denver, Colo.—1,625,058.

Process for Briquetting Bituminous Coal. Srinivas Ram Wagel, New York, N. Y., assignor to The Lehigh Coal and Navigation Company.—1,623,764.

Process for Desulphurizing Coal, Water, or Mixed Gases for Illuminating or Heating. Emil Raffloer, Duisberg-on-the-Rhine, Germany, assignor of one-half to Wm. E. Leuchtenberg, New York, N. Y.—1,624,625.

Method of Furnacing in Thermo-Chemical Treatment and Apparatus Therefor. Charles B. Jacobs, Wilmington, Del., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del.—1,625,610.

Process for the Concentration of Dilute Acetic Acid. Hermann Suida, Modling, Austria.—1,624,810.

Concentration of Dilute Acetic Acid. Hermann Suida, Modling, Austria.—1,624,-811.

Method of Concentrating Dilute Acetic Acid. Hermann Suida, Modling, near Vienna, Austria.—1,624,812.

Centrifugal Separator. Thomas Christian Thomsen, Copenhagen, Denmark, assignor to Messrs. Koefoed, Hauberg, Marstrand & Helweg Aktieselskabet Titan, Copenhagen, Denmark.—1,625,919.

Humidifier. Stuart W. Cramer, Cramerton, and William B. Hodge, Charlotte, N. C., assignors, by direct and mesne assignments, to Wm. B. Hodge Company, Charlotte, N. C.—1,626,666.

Kiln for Glass Melting and Like Purposes. George E. Crawford, Trenton, N. J., assignor to American Dressler Tunnel Kilns, Inc., Cleveland, Ohio.—1,623,779.

Method of Separating Gaseous Mixtures. Jean Le Rouge, Boulogne, France, assignor to Societe l'Air Liquide (Societe Anonyme pour l'Etude et l'Exploitation des Procedes Georges Claude), Paris, France.—1,626,345.

Water Softener. Vernon L. Tannehill, Fort Wayne, Ind., assignor to Fort Wayne Engineering and Manufacturing Co., Fort Wayne, Ind.—1,626,055.

Water-Softening Reagent and Process of Preparing Same. Abraham S. Behrman, Chicago, Ill., assignor, by mesne assignments, to General Zeolite Company, Chicago, Ill.—1,624,711.

Water-Softening Apparatus. Charles P. Eisenhauer, Dayton, Ohio, assignor to The Duro Company, Dayton, Ohio.—1,625,197.

Apparatus for Deflocculating and Emulsifying. Edward A. Butler, Buffalo, N. Y., assignor to Colloidal Equipment Corporation, New York, N. Y.—1,624,037.

Emulsification of Oils and Fats and Products Made Therefrom. Robert Douglas and Hugo G. Loesch, Rochester, N. Y., assignors to Douglas-Pectin Corporation, Rochester, N. Y.—1,625,641.

Photographic Emulsion and Material and Process Used in the Preparation Thereof. Samuel E. Sheppard and Reuben F. Punnett, Rochester, N. Y., assignors to Eastman Kodak Company, Rochester, N. Y.— 1,623,499.

Composition of Gum Chicle Dispersed in an Aqueous Colloid. Arthur Biddle, Trenton, N. J., assignor to United Products Corporation of America.—1,624,088.

Process of Making Perfumed or Medicated Transparent Soaps. Paul Villain, London, England.—1,626,708.

Soap Compound and Process of Making the Same. Hugo Henry Hanson, Bangor, Me., assignor to Tarratine Manufacturing Co. Inc., Bangor, Me.—1,623,340.

Edible-Fat Composition. Harry E. Dubin, New York, N. Y., assignor, by mesne assignments, to H. A. Metz Laboratories, Inc., New York, N. Y.—1,624,164.

Method of Producing an Edible Protein Product. John W. M. Bunker, Belmont, Mass., assignor to American Protein Corporation, Boston, Mass.—1,624,036.

Kiln for the Burning of Cement. Carl Naske, Berlin-Charlottenburg, Germany.— 1,622,337.

Means for Gas Separation. Horace Dumars, New Suffolk, and William Spencer Bowen, New York, N. Y., assignors to Bowen-Dumars Power Corporation, New York, N. Y.—1,622,134.

Press for Making Briquettes. Hugo Apfelbeck, Falkenau, Czechoslovakia. — 1,620,621.

Process of Treating Acid Sludge to Provide a Fuel. Willard Duglas Kinkade and Charles Joel Baugh, Barnsdall, Okla.— 1,621,071.

Apparatus for Regeneration of Zeolites and the Like. Walter H. Green, Chicago, Ill., assignor, by mesne assignments, to General Zeolite Company, Chicago, Ill.— 1,620,886.

Water Softener. Norman E. Brice, Brooklyn, and Herbert G. Snyder, New York, N. Y., assignors to The Permutit Company, New York, N. Y.—1,620,717.

Apparatus for Producing Refrigeration. Frederick G. Keyes, Cambridge, Mass., assignor, by mesne assignments, to National Refrigerating Company, Boston, Mass.— 1,622,519.

Process of Effecting Agglomeration in Paper Pulp and Other Suspensions and Mixtures. Karl Sveen, Aas Landbrukshoiskole, Norway.—1,622,474.

Process and Apparatus for Making Paper or the Like. Carlton H. Allen, Dayton, Ohio.—1,620,860.

Treatment of Pulps. Alfred Leslie Blomfield, Colorado Springs, and Elmer Randall Ramsey, Denver, Colo., assignors to The Dorr Company, New York, N. Y.—1,619,807.

Process of Tanning. John K. Tullis, New York, N. Y.—1,621,612.

Method of Producing Gas. Orestes U. Bean, New York, N. Y., assignor to Bean Process Syndicate, Incorporated.—1,621,652.

Production of Concentrated Acetic Acid from Dilute Aqueous Solutions of the Same. Hermann Suida, Modling, Lower Austria, Austria.—1,621,441.

Process for Producing Aqueous Solutions of Free Cyanamid. Anthony Moultrie Muckenfuss, Woodbridge, N. J., assignor to The Roessler & Hasslacher Chemical Co., New York, N. Y.—1,622,731.

Process of Decreasing the Rate of Crystallization of Borax from Brine. Alfred W. Gauger and Henry Herman Storch, Westend, Calif., assignors to Burnham Chemical Company, Reno, Nev.—1,621,927.

Plating Metals. Bertrand S. Summers, Port Huron, Mich., assignor to The Locomotive Terminal Improvement Co., Chicago, Ill.—1,619,835.

Process of Treating Liquids. Wilson Evans, Chicago, Ill., assignor to Aluminate Sales Corporation, Chicago, Ill.—1,620,332.

Paint and Varnish Remover. Owen Parker Swift, Halifax, England, assignor to Chadeloid Chemical Company, New York, N. Y.—1,620,409.

Method of Preserving Wood and Solutions Therefor. Leo P. Curtin, Freehold, N. J., assignor to The Western Union Telegraph Company, New York, N. Y.— 1,620,152.

Separation of the Constituents of Ternary Gaseous Mixtures. Walter Wilkinson, Jersey City, N. J., assignor to Air Reduction Company, Incorporated, New York, N. Y.—1,619,909.

Process and Apparatus for Conducting Chemical Reactions. Charles O. Young, Elmhurst, N. Y., and Clarence J. Herrly, Pittsburgh, Pa., assignors to Carbide and Carbon Chemicals Corporation.—1,620,180.

Fungicide and Method of Preparing Same. John H. Reedy and William S. Brock, Urbana, Ill.—1,620,229.

Bituminous Composition. Lester Kirschbraun, Chicago, Ill.—1,620,900.

News of the Industry

Electrochemists Hold Silver Jubilee Meeting

The Silver Jubilee meeting of the American Electrochemical Society was held in Philadelphia, Apr. 28-30. The society was founded in that city 25 years ago, and the present meeting brought out a large number of charter members to celebrate the event. The feature of the program was a dinner meeting at the Old Mohican Club where a planked shad dinner was served and a score of speakers reviewed the progress in electrochemistry and electrometallurgy during the past 25 years. Dr. Edgar Fahs Smith presided on this occasion.

The technical program included three symposia: One on the gaseous reduction of ores and other metal compounds, under the direction of Frank Hodson; another on the electrochemistry of concentrated solutions, organized and directed by Hugh F. Taylor, and the third on electrodeposition under the chairmanship of the president of the society, Dr. William Blum. The number of papers offered, including those reviewing the past 25 years in electrochemistry, was the largest at any meeting of the society, and the entire meeting was one of the most successful held in recent years. Reviews of some of the technical papers are published elsewhere in this issue.

Officers were elected as follows: president, S. C. Lind; vice-presidents, Duncan McRae, Paul J. Kruesi and Robert Turnbull; managers, Oliver C. Ralston, R. L. Baldwin, and H. C. Cooper. Acheson Smith and C. G. Fink were re-elected treasurer and secretary respectively.

Production and Sales Cartel in Italian Dye Industry

The Fabbriche Italiane Materie Coloranti Bonelli announces that an agreement has been reached between their company and the group which controls the S.I.P.E. Cengio, the Italica, the Schiapparelli and the Unione Produttori e Consumatori di Materie Coloranti Artificiali, covering production and sales of intermediates and dyes, according to advices to the Department of Commerce from the office of the commercial attache, Rome.

By the terms of the agreement, the capital of the Bonelli company has been increased from 45,000,000 lire to 60,000,000 lire, which enables them practically to absorb the Italica. Large amounts of French capital are reported to be invested in these companies and the controlling shares are said to be in the hands of the Societa Italiana del Gas of Turin.

The object of the agreement, it is announced in Italy, is to expand production and to do away with competition among these companies. The Unione Colori is the organization which was handling German dyestuffs on account of reparations for the Government.

British and German Chemical Interests in Agreement

A cable received May 13 from Commercial Attaché Cooper at London by the Chemical Division of the Department of Commerce reports that negotiations which have been in progress have reached a conclusion and it is officially confirmed that a working agreement has been entered into between British and German chemical combines. The exchange of patents and other data and the control of production and marketing are contemplated under the proposed agreement. The cable continues to the effect that dyestuffs will be the first commodities affected with extension later to the general chemical field.

This confirms European press reports that leading British and German organizations were negotiating. These reports had stated that the contemplated combination would control as much as 37 per cent of the total world production and exports of chemicals and two-thirds of the dye output of the world.

Seismograph in Growing Use for Oil Exploration

Within the last few months there has developed a pronounced use for the seismograph in the search for oil in Eastern Texas, and a number of companies have crews using these instruments in exploration operations for locating salt domes. In practical operation, the seismograph crews make and record vibrations beneath the surface of the earth, these vibrations being set in motion by charges of dynamite. The various velocity and refraction of the seismic waves thus set in action are recorded and interpreted; the seismologist knows the rate of speed of the vibrations through various kinds of strata, and in reading the instrument he is able to tell approximately what formations lie between the point of the discharge of the dynamite, usually placed in the earth from 5 to 10 ft., and the point where the seismograph is recording. Within the past few weeks no less than four crews have been working at Athens, Tex., and vicinity.

Litigation Aroused by Pitch Dust Explosion

Suits for damages amounting to nearly one million dollars have been entered by various concerns and individuals whose interests were affected by the explosion and fire aboard the *Richelieu* on January 4, while she was being loaded with a cargo of soft pitch. Approximately forty stevedores were engaged in loading the steamer, employing the methods for coal and other such material which are customary at the Curtis Bay pier of the B & O Railroad in the Baltimore, Md., harbor. The explosion and fire occurred below deck killing six and injuring more than thirty workmen, several fatally, and the boat finally sank at the pier after listing badly during the progress of fire fighting.

Much controversy has been aroused among the interested parties both as to the cause of the accident and the liability of each therefore. An indirect result of the disaster has been the establishment of some new regulations for the handling of this type of material. However, in view of the litigation still pending, no definite findings have been announced by the various technical investigators engaged on the project.

Fuel Engineering to Be Offered At Pennsylvania

Leading national authorities will act as instructors in the one-year course in fuel engineering to begin Sept. 30, 1927, announces the Towne Scientific School, University of Pennsylvania. The course, which leads to the degree of Master of Science in Fuel Engineering, will embrace the following general subjects: Fuel Resources; Mining Methods; Composition and Combustion of Fuels; Manufacture of Special Fuels; Uses of Fuels and Specifications for Purchase; Furnaces; Fuel Sampling; Analysis and Calorimetry; Fuel Testing in Heating and Power Appliances; Domestic Heating; Regulations Affecting Use of Water Power and Fuel Resources; Research; Electives.

Dr. Robert H. Fernald, formerly engineer in charge, Technologic Branch, U. S. Geological Survey, and later consulting engineer, Fuel Division, Bureau of Mines, is now director of the Mechanical Engineering Department and director of the Course in Fuel Engineering. Applications for enrollment, however, should be addressed to Dean John Fraser, Towne Scientific School, University of Pennsylvania, Philadelphia, Pa.

Increased Production Advocated at Conference in Geneva

Lower Tariffs in Europe, Government Intervention in Industry, Capitalist System Among Topics Discussed

By E. J. Mehren
Vice-President, McGraw-Hill Publishing Co., Inc.
Cabled from Geneva

THE International Economic Conference at Geneva opened on May 4 with 47 countries including Soviet Russia represented by delegates.

The first four days were devoted to a survey of the world's economic ills. There was general agreement that increased production was the indicated remedy, thereby increasing purchasing and consuming power and raising the standard of living. A striking note was the general solicitude for the well-being of workers, which was probably a new idea with European employers. The keenest analysis of the situation was made by W. T. Layton, editor of the *Economist*. He contended that we could not return to pre-war conditions. In his opinion a new equilibrium must be established due, first, to the great increase of industrialization; second to the fact that the United States is now a creditor nation but apparently does not desire to buy from the countries she finances, contrary to the policies of former financing nations; third, to the decrease of European emigration; and fourth, to the alteration of trade relations resulting from the payment of reparations and international war debts. The situation is more acute because Russian imports are small and Central Europe is divided by high tariff walls, resulting in duplication of industrial plants and preventing specialization which is the essential feature of modern industrialism.

European Tariffs

Mr. Layton's insistence that the tariff walls of Central Europe must be lowered was approved by numerous speakers. There also was general approval of tariff stabilization regardless of the level, thus encouraging long-time contracts, uniform tariff classification and nomenclature. Long-time commercial treaties were advocated. There was no reference to American tariff rates but several indirect references to our prohibition of immigration. Financing of backward countries was urged to stimulate production.

Dr. Carl F. Von Siemens, of Germany, criticized government intervention in industry, which was particularly interesting as coming from the representative of a country where government assistance and compulsion are considered normal. Zimmerman, of Holland, cited increased government services and restrictive labor legislation as increasing the industrial burden by raising prices, restricting consumption and reducing trade. The remedies suggested were removal of government interference and reduction in number of non-productive public servants. Only Shidachi, of Japan, and Layton, of Great Britain, cited the wastefulness of armaments.

The speech of Henry M. Robinson, chairman of the American delegation, was well received. He sketched the development of our prosperous industrial situation, stressing the determination of American employers to secure needed economies by better management and machinery, but not by wage reduction. He affirmed the American belief that competition stimulates industrial progress and suggested that the American delegation would probably disapprove of international cartels if governments participated or if they were exploitive in character. Answering Sir Max Muspratt, of England, who thought that rubber restriction bore equally on everyone, Mr. Robinson contended that there was discrimination against America which uses 75 per cent of the output as against only 7 per cent by Great Britain.

Sokolnikoff, of Russia, painted an optimistic picture declaring that industrial and agricultural production are now in excess of pre-war outputs, but the figures are doubted here. He made a strong plea for closer capital and trade relations, contending that the capitalist and socialist systems can work harmoniously together. He also spoke at length in protest of the boycott now enforced against Russia.

Obolenski Ossinski, of Russia, criticised the capitalist system severely, declaring it to be the cause of the World War. He accused it of glaring inconsistencies such as longer working hours while unemployment continued on a large scale. He condemned cartels and repeated Sokolnikoff's plea for trade relations, emphasizing the importance of the Russian market. In conclusion he offered eleven suggestions for restoring world trade and prosperity: cancellation of war debts, increase industrial wages, eight hour day for all workers except miners, who should have six, fullest liberty for trade union organization and complete liberty for strikes, relief for the unemployed, raise funds for the unemployed by taxation, decrease unproductive expenditure, especially for armaments, abolish barriers against immigration, cancel protectorates and mandates and permit self-determination for all peoples, no intervention in China, suspend economic boycott on Russia and extend credits to that country.

It is not expected that the conference will have great or important immediate results but that it will contribute to a better understanding of international problems and will lay a basis for some definite actions now and in the future. Three speakers advocated permanent organization for the study of international economic problems. The plenary sessions closed Saturday, May 7, and committee sessions on commerce, industry and agriculture began Monday, May 9.

Higher Import Duty Asked for Plate Glass

On May 2, Senator Reed of Pennsylvania advocated a higher import duty on plate glass as a protective measure for the home industry. Hearings were conducted last week on the petition for a lower duty on glass as filed by importers. In the application for a higher duty it is complained that the manufacturers of Belgium and Czecho-Slovakia have been delivering glass in this country at prices less than the cost of domestic production. The whole condition is due, according to Senator Reed not to any superiority on the part of the foreign manufacturers in producing glass, but to the fact that the workmen of the foreign factories receive about one-fourth the wages that domestic manufacturers have to give.

The Tariff Commission now has before it five applications covering the glass industry—plate glass, window glass, perfume bottles, clinical thermometers and table ware. The plate glass investigation has made some little headway, although it has been before the commission for several years. A part of the delay was due to the fact that the foreign manufacturers had refused to furnish cost figures. They have changed their attitude and this necessitated a further public hearing, which began May 9.

Lafayette B. Mendel Receives Gold Medal of A.I.C.

At the dinner of the American Institute of Chemists, held May 11 at the Chemists Bldg., New York City, the gold medal of the Institute was presented to Prof. Lafayette B. Mendel of Yale University for meritorious work in academic service. Prof. Treat B. Johnson, president of the Institute reviewed the work of the organization and referred to opportunities in the field of pure and applied science. Dr. Graham Lusk of Cornell University spoke in praise of the work of Dr. Mendel in the field of food research. Dr. Mendel spoke on the subject "Some Tendencies in the Promotion of Chemical Research."

At the business meeting which preceded the dinner the following were elected directors: M. L. Crossley, C. H. Herty, C. L. Reese, H. R. Moody, and H. G. Byers.

Higher Output of Coal-Tar Intermediates Last Year

On April 11, 1927, the Tariff Commission published preliminary figures on the domestic production and sales of dyes and synthetic organic chemicals.

The following supplementary statement and table show the production and sales of the principal coal-tar intermediates for 1926.

The total output of intermediates in 1926 was 229,549,000 lb., as compared with 210,699,779 lb. in 1925. The sales in 1926 totaled 86,895,000 lb. valued at $18,976,000, or a unit value of 21.8c. per lb. This is a slight increase by quantity and 4 per cent decline in value from the previous year.

News from Washington

By Paul Wooton

WASHINGTON CORRESPONDENT OF *Chem. & Met.*

BY SELF regulation American business is bringing about a condition which will result in fewer restrictions being imposed upon private enterprise and initiative through government regulation. This was the key-note in the address of John W. O'Leary, made at the opening session of the annual meeting of the Chamber of Commerce of the United States, which was held in Washington, May 2, 3 and 4.

Labor and capital have entered upon a new era, in opinion of speakers at the manufacturing session. America's ideal now is the application of the Golden Rule to labor relations. A striking feature of this session was the fact that no less than twelve of the speakers who took part in the discussion emphasized the far-reaching benefits which have followed the enactment of prohibition legislation. No single word was advanced in opposition to the law and no suggestion for its modification was forthcoming. Prohibition was held to be a question of human welfare and an economic matter rather than a political question.

Government Doles

The evils of any system of government doles or pensions were pointed out. Workers should be paid generously, it was held, and then would be in a position to provide their own insurance against old age or unemployment. An essential to the placing of industrial relations on a basis of justice, it was contended, is the payment of wages in proportion to the production of individual wage earners. By encouraging creative power among the people and by encouraging individual productivity a great increase in buying power is brought about.

The point that money is not enough to compensate the workers fully was made with great effectiveness by Arthur T. Morey, the general manager of the Commonwealth Steel Company of St. Louis. He advocated the development of various comforts and advantages which could be offered to employees and such guidance and aid that did not partake of paternalism. He declared the safety movement was the opening wedge for the better industrial relations which exist today. He stated that the home loan department of his company never had lost a dollar. The losses from money advanced for fellowship purposes had been less than one per cent. Good wages and compensation in these other ways make for contented workers, an essential to high productivity and low unit costs.

H. H. Rice, assistant to the President of the General Motors Company, declared that high wages are more a result of prosperity than prosperity is the result of high wages. Prosperity, he asserted, is a result of high average production per man. Labor is paid more in this country than in any other, he said, because of good management, avoidance of waste, prevalence of research, prohibition and many other factors, and by the equipment at its command.

City Building

City building so as to relieve both street congestion and transportation demands, was the feature of the civic development session May 3. John Ihlder, the manager of the civic development department of the Chamber of Commerce, made the statement that the success of the American people can be measured only in the ability of their business men to plan effectively for the future. Their vision must be exerted in city development so that it may proceed along sound economic lines.

Robert Kingery, of the Chicago Regional Planning Association, told in detail of the work being done to improve conditions within a radius of fifty miles from the Loop district. The objective is not the city beautiful, but the city practical, he declared. In towns of from 3,000 to 50,000 population it was held that fifty front feet per 100 population should be devoted to business purposes. There should be ten acres of park per 1,000 population, he estimated. The division between large and small parks should be on a sixty-forty basis.

The skyscraper is not a disease but a solution of business perplexities, it was contended by Harvey Wiley Corbett, a New York architect. They reduce street congestion and enable business men to conduct operations in limited areas, he argued. With business hours growing shorter and the volume of business done growing larger, the skyscraper is as essential to efficiency as is the telephone or the automobile. To reduce building heights to seven or eight stories in the 42d Street area of New York City would require one and one-half square miles of new territory and would so lengthen the lines of communication as to promote rather than decrease street congestion. It is his opinion that vertical transportation is easier to handle than horizontal transportation, particularly since automobiles take 400 square feet of street area when traveling rapidly, 200 square feet when they are moving slowly, and 100 square feet when they are standing. Street capacities, he asserted, must be made to fit the capacity of building, even if double deck or triple deck streets may be made necessary.

Major Henry Curran, also of New York, spoke in opposition to the skyscraper. He holds that they make for congestion, particularly during rush hours, and that failure to control heights spoil the appearance of cities. Because of skyscrapers, he said, New York is faced with the necessity of putting all of its funds into new subway transportation facilities instead of building schools, parks and playgrounds.

Arthur S. Bent, of Los Angeles, pointed out that in his city building heights are limited to fifteen stories, or 150 feet. This has resulted, he stated, in the growing up of small centers with business districts of their own. The effect has been to spread property value. Fred E. Reed, of Oakland, urged that height limit be established, but said that the economic height of buildings must be considered in relation to various conditions. He pointed out that the limit of height in Germany is 72 feet, in France, 65 feet, and in London 80 feet.

Fixed Nitrogen in Germany

In 1926, 440,000 tons of Germany's 600,000-ton output of fixed nitrogen was produced by the Haber-Bosch process, according to Dr. Nicodem Caro, co-inventor of calcium cyanamide. He credits calcium nitrate and nitrophoska with a considerable portion of the 100,000 tons increase over 1925.

Of the total Dr. Caro estimates that 58 per cent was used for agricultural purposes. One-third of the output, he states, was exported and the remainder used in industry.

Piping of coke oven gas for long distances is to be undertaken by Kohlenverwertungs A. G. of Essen. Half of the gas produced at Ruhr ovens is used for heating the coke furnaces. Difficulty is experienced in disposing of all the other half. A portion is sold for domestic use in nearby cities. It now is planned to pipe the gas out of the Ruhr within a radius of some 200 miles.

Efforts of the Wintershall Concern to confine potash production to the low cost mines and to sell on a close margin so as to stimulate consumption, apparently have been blocked effectually. Burbach interests have purchased certain mining shares held by the Wintershall concern. Herr Rosterg continues to hold the majority of the stock in the Wintershall company, but it is noted that he has not been made a member of the board of the Burbach holding company and it is apparent that the organized industry has gained the upper hand.

The large recent increase in the German output of cellulose and oil lacquers is attributed to the activities of the I. G. which since its absorption of the Kohn-Rottweil company has occupied a leading position in the industry.

Information reaching Washington indicates that the Chile Iodine Producers' Association bids fair to go the way of the Nitrate Producers' Association. The dissolution of the association has been hastened, it is reported, by the adverse court decision in the case of the association against Pablo Marinkovic. The Court of Appeals at Iquique upheld Mr. Marinkovic in selling the total production of his property for a period of five years. There has been increasing hostility in Chile, it is stated, to the policy of the association in restricting production to the point where only a small portion of the iodine resources were sold so as to maintain a high level of prices.

Further Amalgamations Probable in British Chemical Industry

Nucleus for Another Chemical Combination May Result from Change in Control of British Alizarine Co.

From our London Correspondent

THE principal topic of conversation recently has related to Mr. Churchill's budget proposals and now that the country knows both the worst as exemplified by losses due to the coal strike and other troubles, and the best as shown by a reduction in the bank rate and a better national economic showing than was anticipated, it looks as if we should see a genuine trade revival. Mr. Churchill is not likely on future occasions to have to show as much ingenuity in balancing his accounts. Certainly the chemical trade made as good a showing as any other in maintaining a good level of production and profit, and it may be said that very few countries could have faced in the same satisfactory manner the shock of a prolonged coal stoppage and the heavy losses it entailed.

The chemical industry has also contributed to relieve the strain on national finances owing to the heavy tax that was paid on capital when Imperial Chemical Industries was constituted as a limited company and that this is unjust has been confirmed by one of the provisions of the budget by which such taxes can be remitted in cases where it can be shown that new organizations or amalgamations are technically and economically advantageous.

There is still talk of an extension of amalgamations in the British chemical industry but as it would seem that Imperial Chemical Industries are finding it difficult to get into their stride, it will probably take some time before anything definite materializes. The two predominating partners, Brunner Mond and Nobel Industries have fairly well defined fields of enterprise and the position of the United Alkali Co. in relation to the others is not very complex. When it comes to British Dyestuffs Corporation however, the matter becomes much more difficult and the other three firms might have conflicting ideas in regard to interlocking manufactures or developments. So far the only pointer has been an announcement that "Necol" dressings for leather will be marketed by the British Dyestuffs Corporation. On the other hand it is understood that control of the British Alizarine Co. is to pass to Brotherton and Co., Ltd., of Leeds, so that this may be a nucleus of another chemical group. In the artificial silk field several of the smaller companies are already having difficuties and others are falling behind in their production program, but against this some of the new companies are doing well and are in a good position so long as the market remains in a satisfactory condition and their production does not encroach too much on the preserves of the big producers.

The cellulose acetate field is in a more interesting position and being a relatively new and if anything superior product for its special applications there is more room for enterprise and expansion and even for international arrangements, rumors regarding which are already rife.

Interest has again revived in the exploitation of the chemical resources of the Dead Sea in Palestine, and the number of applicants that can be considered has been narrowed down considerably and it is not unlikely that a decision will be made before the end of the year. The resources have recently been summarized as follows: Potash, 1,300,000,000 tons; bromine, 853,000,000 tons; salt, 11,900,000,000 tons; gypsum, 81,000,000 tons; magnesium chloride, 22,000,000,000 tons. The possibilities as regards potash and bromine will be of more particular interest to American readers, but it is too early to estimate the effect.

Production of Oil from Coal

Developments are proceeding both here and in Germany in regard to the production of oil from coal. The Bergius process is a matter of more immediate importance where brown coal is obtainable cheaply whereas in this country the Bergius process is not always more attractive than straightforward low-temperature carbonization. The Fuel Research Board in England has installed a Bergius unit with a capacity of one ton per day and experimental work is proceeding in various localities. In Germany, on the other hand, an enormous plant is under construction at the I. G.'s Leuna Works, 12,000 men being at work day and night. This plant is reputed to be planned for a daily consumption of 15,000 tons per day of brown coal and working on a combined gasification and Bergius process, is estimated to supply about 15 per cent of the German home consumption of motor spirit. The question of transport presents some difficulty and this development may be of considerable importance if the methods adopted should prove suitable for the treatment of Canadian lignite. It will be interesting to see whether and to what extent corresponding action is taken by Imperial Chemical Industries and it is not at all unlikely that ultimately they will seek to control rather than participate as at present, in the British rights of the International Bergius Syndicate.

In the synthetic ammonia field it is understood that in the court of first instance the claims of the Mont Cenis interest were upheld as against the opposition of the German I. G. A new company has been formed to handle and control the large plant which is now under construction at Sodingen and another plant at the works of the Hibernia colliery. The latter also participates in the new company and as it is believed that the German government has a financial interest it would seem that influences are at work to counteract the virtual monopoly in the nitrogen fertilizer field which is at present enjoyed by the German I. G. The Sodingen plant is likely to be in operation before the end of the year.

California Bromine Production To Be Increased

The California Chemical Corporation which is the principal producer of magnesium chloride on the Pacific Coast, has completed arrangements for consolidation of its holdings in the San Francisco district preparatory to major plant expansion there. This concern has been manufacturing magnesium chloride and potash salts for several years at its Chula Vista, Calif., plant. During 1926 bromine production was also undertaken there. Recently the plant and properties of the Industrial Chemical Corporation at Newark, and the Whitney Chemical Co. at San Mateo, were acquired. These purchases together with the consummation of long term contracts with the Leslie California, the Western, and the Arden Salt companies put the California Chemical Corporation in control of the sea water bittern derived from the immediate production of some 250,000 tons of solar salt yearly, while more than double this quantity will become available in the near future.

Plans call for the immediate erection of a bromine plant at San Mateo and for the continuance of production of magnesium chloride at Newark, with the erection of a major bromine, magnesium compound and diversified chemical operation in the Newark district to go forward shortly. Production of magnesium and potash compounds and of bromine will be continued at Chula Vista.

Potash Drilling in New Mexico Proves Disappointing

The core from the first potash well drilled by the Bureau of Mines in New Mexico is commercially disappointing. While interesting showings of potash were found, it is apparent that no important stratum of potash exists at the point where this sample was taken.

The new contracts now have been approved by the various legal officials concerned which will open the way for drilling the sites which the Geological Survey selected in Texas. These were the preferred sites, but a change had to be made in the law before the land owners would enter into the agreement to reimburse the government from any sales of potash that might result from its discovery. The remaining two sites in New Mexico will be drilled, however, before any drilling will be done in Texas.

Higher Salaries for Chemists

After having tried for several months to obtain a properly qualified chemist to serve as chief of the Bureau of Chemistry and Soils at a salary of $6,000, arrangements have been made to increase the rate of pay to $7,500. An assistant chief also is to be chosen. That position pays $6,000 under the new schedule.

Provisional Trade Agreement Signed By France and Germany

Minimum Import Duties Granted To German Chemicals—French Dye Makers Plan To Meet Outside Competition

From our Paris correspondent

A NEW provisional trade agreement between France and Germany was signed at Paris, March 31. This commercial treaty is to continue until June 30, 1927. Upon its expiration it is probable that a long term agreement will be consummated. In the meantime several chemicals from Germany may be imported by France under minimum tariffs, the quantities being prescribed. The amounts of chemicals which are granted minimum import duties include ammonia chloride, 150 tons; barium carbonate, 750 tons; sodium bichromate, 175 tons; magnesium carbonate, 75 tons; potassium carbonate, 203 tons; carbon sulphuret, 225 tons. Among the organic products authorized to be imported under the conditions of the minimum tariff are acetic anhydride, 15 tons; formic acid, 30 tons; accelerators for the rubber industry, 21 tons; crotonic aldehyde, 15 tons; glycol and its ethers and esters, 75 tons.

There also has been formed what amounts to an agreement among French producers of dyes. This agreement has taken the form of a committee such as has been functioning in the metallurgical and coal industries. This committee will work in the interest of dye manufacturers with a view of overcoming competition from German dyes.

Two problems which are receiving attention from French chemists and engineers involve fixation of nitrogen and production of synthetic motor fuels. Fixation of nitrogen is making some progress to depart from high pressures which are necessary, for instance, where the Claude process is followed. On the other hand low pressures make necessary apparatus of large dimensions and opinion is divided regarding the superiority of low pressure or high pressure processes.

Disappointing reports have come from Toulouse regarding the nitrogen plant at that place. Considerable installation work is still to be done and difficulties have arisen in setting up the catalyzing apparatus. It is now stated that the plant will not go into production this year. This is in contrast to earlier reports which predicted an output of 50,000 tons of nitrogen this year. Even if this amount could be produced the return would net only about 2,500,000 francs which would represent a little more than 1 per cent on the 200,000,000 francs invested in the plant. Meanwhile, according to the agreement made, the French government is paying license fees to the Badische Anilin and Soda-Fabrik and the inability to operate the Toulouse plant makes it necessary to continue importations of sulphate of ammonia from Germany.

With a domestic consumption of one million tons annually, there is a keen incentive to establish production of synthetic motor fuels in France. The Bergius process has been secured for this country by a company in which Schneider & Co. hold the controlling interest. Owing to difficulties encountered in direct hydrogenation of fossil fuels the process will not be put into use. The Mines of Bethune are producing gasoline under a patented process with methane as a starting point. Bethune being a partner in the recently formed company of Carburants et Produits de Synthese, it is supposed that this company will use the Bethune process.

It is difficult to secure reliable data on production of synthetic gasoline from specific quantities of coal. It is estimated that four and one-half to seven kilograms of coal are required to produce one kilogram of gasoline. At this rate it is difficult to see how synthetic gasoline can compete with the natural product.

It is reported that the Badische Anilin and Soda-Fabrik has built and in six months will have in operation, a plant near Merseburg which will use a process similar to the Prudhomme.

By a decree of March 18, 1927, the gas plant of Bourges is compelled to debenzolize within a period of two years, the lighting gas produced by it. Thus, little by little, all important gas plants of this country are submitting to this rule which means in a near future a large production of benzol. For this debenzolizing, gas plants prefer the Still process which gives a 90 per cent benzol directly available for sale.

To Establish Summer School for Engineering Teachers

The Society for the Promotion of Engineering Education announces that a summer school for engineering teachers will be established and the first sessions held in the summer of 1927. The Carnegie Corporation of New York has appropriated funds to operate the school for one year. The establishment of the school is an outgrowth of the extensive investigation of engineering education which the Society has been conducting for the past three years.

Two sessions of the school, each of approximately three weeks duration, will be held during the first year. Cornell University and the University of Wisconsin have been tentatively selected as sites and negotiations opened with the authorities of those institutions. It is expected that tuition charges will be limited to a nominal registration fee and that costs of meals and rooms will be quite low.

The work of the school will center around the teaching of particular subjects of the engineering curriculum. The teaching of mechanics has been selected for the first sessions since that subject is fundamental to all branches of engineering. The work will be divided into three principal divisions: the teaching of pure mechanics, the applications of mechanics in related fields, and the exposition of methods of teaching in general.

For the first year, at least, the school will be conducted under the general supervision of the Society's Board of Investigation and Co-ordination, which board is charged with the duty of conducting the general investigation of engineering education. Immediate supervision will be in the hands of H. P. Hammond, Associate Director of Investigation.

Larger Production of Aluminum Salts in 1926

The production of aluminum salts in 1926 was 373,695 short tons, valued at $13,202,010, as compared with 335,480 tons, valued at $13,155,790, in 1925, according to information compiled by the United States Bureau of Mines.

The aluminum salts industry consumed 114,570 long tons of bauxite in 1926 as compared with 122,340 tons in 1925. Bauxite consumed in 1926 was 65 per cent from domestic deposits and 35 per cent imported ore. There was also consumed 200 tons of aluminum metal, used in the manufacture of alumina hydrate, and 3,800 tons of aluminum hydrate.

Aluminum salts produced in the United States in 1926

	Number of Producers Reporting	Short Tons	Value
Alum:			
Ammonia	5	4,560	$276,480
Sodium	6	16,740	953,840
Alumina, calcined and hydrate	3	3,910	287,660
Aluminum chloride, anhydrous and hydrate	5	16,750	3,562,690
Aluminum sulphate:			
Commercial—General	14	307,550	7,374,940
Municipal	5	7,130	134,590
Iron-free	7	16,160	557,460
Other aluminum salts	..	895	54,350
	...	373,695	$13,202,010

Standard to Be Established for Sulphate Wood Turpentine

A standard for sulphate wood turpentine will be established at a public hearing on August 15, 1927, according to an announcement by the Secretary of Agriculture, W. M. Jardine. No standard is established by the Naval Stores Act for the product.

The hearing will be held at the office of the Food, Fruit and Insecticide Administration. The full text of the notice follows:

Pursuant to the authority vested in the Secretary of Agriculture by the Naval Stores Act of March 3, 1923, notice is hereby given to the trade of the intention to establish a United States standard for naval stores for which no standard has been established. This standard is for sulphate wood turpentine. Under this standard "Sulphate Wood Turpentine" means wood turpentine obtained in cooking resinous wood by the sulphate process, and subsequently so refined that it has a characteristic but not offensive odor, contains not more than 0.02 per cent of sulphur, and will not tarnish a bright strip of copper boiled in it for one-half hour.

News in Brief

New Wallboard Plant to Use Cornstalks—The Maizwood Products Corporation, Chicago, Ill., has purchased property at Dubuque, Iowa, and has plans under way for the erection of a new plant for the production of wall board and kindred structural specialties, using cornstalks for raw material. The initial works will contain complete chemical laboratory and research department, and is estimated to cost approximately $100,000, with equipment.

First Oil Refinery to Be Built in Michigan—The Standard Oil Co. of Indiana has concluded arrangements for the construction of an oil refinery near Saginaw, Mich., to be the first such plant ever constructed in that state. The new refining plant will be constructed to provide for the output of the Fordney Oil Co. of Saginaw and other interests in adjacent fields. It will be equipped to handle an initial production of 1,000 bbl. of crude oil per day.

Meeting of American Refractories Institute—The annual spring meeting of the American Refractories Institute will be held May 18, at the Hotel Traymore, Atlantic City, N. J. A dinner will be held on the evening of that day at which special speakers will appear. A golf tournament will be held on May 19.

Gain in Output of Sodium Compounds.—The production of sodium compounds, not including common salt, from natural salines and brines in this country in 1926, as indicated by sales or shipments by producers, amounted to 93,480 short tons, valued at $2,326,750, according to the United States Bureau of Mines. These figures show an increase of 28 per cent in quantity and 11 per cent in value as compared with 1925. They cover the output of sodium carbonate, sodium bicarbonate, sodium sulphate, trona, and borax.

Leading Chemists to Direct Institute of Chemistry.—Appointment of seven chemists as a Committee of Direction for the national Institute of Chemistry recently founded by the American Chemical Society has been announced by Dr. George D. Rosengarten president of the Society. They are: G. L. Wendt, dean of the School of Chemistry and Physics, Pennsylvania State College; Prof. F. C. Whitmore, Department of Chemistry, Northwestern University; Willis R. Whitney, director of the Research Laboratory of the General Electric Company; C. M. A. Stine, chemical director of E. I. du Pont de Nemours and Co.; C. E. K. Mees, director of research and development, Eastman Kodak Co., Frederic W. Willard, Western Electric Company.

German Potash Sales Increase.—Potash sales of the German Potash Syndicate during the first quarter of 1927 totaled 538,124 metric tons, a figure which was considerably in excess of the total of 419,590 metric tons sold in the first quarter of 1926 and the total of 12,020 tons disposed of in the same period of 1925, according to advices from Trade Commissioner W. T. Daugherty, Berlin. The sales in the first three months of this year, which is the usual period of heavy purchases, were also equal to almost one-half of the total sales in 1926.

New Chemical Laboratory for Princeton.—On Thursday morning, May 12 formal exercises were held at Princeton University in connection with the laying of the cornerstone for a new chemical laboratory and a new engineering building.

Corrosion of Metals Under Study.—A search for an accelerated test to determine the resistance of metals to corrosion is being made by the Bureau of Standards. The Bureau believes that such a process may be found in the voltage required to cause the metal to corrode at a definite rate.

German Plans for Chemical Plant in This Country

Considerable speculation has been aroused relative to the results of the visit to this country recently made by a technical commission representing the I. G. of Germany. While no announcements have been made by the principals there are rumors to the effect that an exhaustive survey of the fertilizer industry was made and that the foreign interests have under consideration the establishment of a plant in this country which will begin operations with the manufacture of concentrated fertilizer. It is further rumored that after investigations were made three sites were selected as suitable for the project, Niagara Falls, Charleston, W. Va., and Monroe, La. Reports also have been current relative to the intention of the I.G. to form a new American company to handle the sales end of the organization. Three men prominent in the chemical industry in New York have been reported to have been selected to head the future company in the capacity of president and vice-presidents.

Second International Conference on Bituminous Coal

A second international Conference on Bituminous Coal will be held at the Carnegie Institute of Technology in November 1928 according to an announcement by Dr. Thomas S. Baker, president of the institution. The statement is contained in recently issued volume of proceedings of the first conference held from November 15 to 18, of last year.

Aldehol Favored as Denaturant for Alcohol

Chemists of the Bureau of Prohibition practically are convinced that aldehol is one of the best non-poisonous denaturants yet discovered. The application of aldehol to this use was worked out in the Bureau's laboratory. It will displace pyridine and benzol in the denaturing formulas.

If aldehol stands all the tests to which it is now being subjected, it will provide a market for some 300,000 gal. of that product and has suggested further research on other oxidized petroleum distillates. This is the first commercial use which has been found for aldehol.

Program for Semi-Annual Meeting of A.I.C.E.

The nineteenth semi-annual meeting of the American Institute of Chemical Engineers will be held at Cleveland May 31 to June 3. The following program has been arranged:

Tuesday, May 31, 1927

10:30 A.M. — Meeting, Hollenden Hotel: "Symposium on Chemically-Resistant Cements," chairman, S. S. Sadtler; "Cements and Lutes," S. S. Sadtler; "Cements for Heavy Chemical Industry," H. B. Bishop; "Cements for Gaseous and Liquid Hydrocarbons," F. W. Sperr, Jr.; "Oxy-chloride and Other Dental Cements," W. S. Crowell; "Silicates of Soda," J. G. Vail.

1:30 P.M.—Plant Excursions: Industrial Fibre Co., W. 98th St.; Manufacture of Artificial Silk. Ladies Invited; National Carbon Company, Inc.; Ever Ready Dry Battery Works; Research Laboratories.

5:30 P.M.—Council Meeting, Hollenden Hotel.

Wednesday, June 1, 1927

9:00 A. M.—Business Meeting.

10:00 A.M. — "Symposium on Rubber," chairman, W. C. Geer; "Solvents in the Rubber Industry," R. P. Dinsmore and W. K. Lewis; "Rubber in Engineering," J. W. Schade; "Hard Rubber for Chemical Industry," J. R. Silver, Jr.; "Development of the Auto Tire," W. F. Zimmerli; "Inside Frosted Bulbs for Incandescent Lamps," Moving Pictures and Slides, Marvin Pipkin.

12:30 P.M. — Luncheon, Hollenden Hotel: Address by Hon. W. R. Hopkins, Manager, City of Cleveland; subject, "Manager Plan of City Government."

2:00 P.M.—Plant Excursions: General Electric Co., National Lamp Works, The Arco Company.

7:00 P.M.—Complimentary Dinner, The Grasselli Chemical Co., Hollenden Hotel.

Thursday, June 2, 1927

11:30 A.M.—Assembly in Conference Room for paper on "Uses of Rubber in Chemical Manufacturing Industry."

12.00 Noon.—Complimentary Luncheon, B. F. Goodrich Co. plant.

1:45 P.M.—Trip through remainder of B. F. Goodrich Co. plant.

8:00 P.M. — Experimental Lecture: Dr. Dayton C. Miller, Prof. of Physics, Case School of Applied Science. Subject, "Photographing and Analyzing Sound Waves."

Friday, June 3, 1927

9:00 A.M.—Technical Session: "Carbonization of Soft-Wood Saw Dust," W. S. Beuschlein; "Application of the Three-Electrode Vacuum Tube in Chemical Engineering, H. C. Weber; "Thermodynamics of Air Separation," B. F. Dodge and C. Housum; "Heat Transmission by Radiation from Non-Luminous Gases, H. C. Hottel; "Inhibitors, their Behavior in Laboratory and Plant," F. N. Speller and E. L. Chappell; "Removal of Rust From Pipe Systems by an Acid Solvent," F. N. Speller, E. L. Chappell and R. P. Russell.

2:00 P.M. — Plant Excursions: General Electric Co., National Lamp Works Glass Division, Nela Park Research Laboratories, Baldwin Reservoir.

Men You Should Know About

H. M. PIERCE, chief engineer of E. I. du Pont de Nemours and Co., Wilmington, Del. has resigned, effective June 1, but will continue in an advisory capacity for the next year. He will be succeeded by E. G. Ackart. Mr. Pierce has also resigned as president and director of the du Pont Engineering Co.

R. A. HART, manager of the Western Clay Products Association, Salt Lake City, Utah, has been appointed president of the Utah Academy of Sciences, succeeding Dr. Thomas L. Martin.

A. M. LAWSON, formerly research chemist for the Victor Chemical Works, Inc., is now research and development chemist for the Calumet Chemical Co., Joliet, Ill.

H. J. HEINTZELMAN, president and general manager of the Monongah Glass Co., Fairmont, W. Va., has recently retired from active management of the company.

A. M. VARNEY, formerly associated with the Boston Woven Hose & Rubber Co., Cambridge, Mass., is now chief chemist in charge of the chemical department of the Ohio Rubber Co., Willoughby, Ohio.

EDWARD L. HARCOURT, recently awarded a bachelor's degree in ceramic engineering at the Ohio State University, Columbus, Ohio, will represent the committee of the university in charge of an experimental ceramic plant to be operated at Roseville, Ohio.

G. W. TALBOT, heretofore connected with the Buffalo, N. Y., plant of the National Aniline & Chemical Co., has been placed in charge of production of the plants of the company, with headquarters at New York.

E. L. CHAPPELL, formerly with the Research Laboratory of Applied Chemistry, Massachusetts Institute of Technology, Cambridge, is now with the National Tube Co., Pittsburgh, Pa., to continue special studies on corrosion of water piping.

C. L. BEAL is now with the B. F. Goodrich Co., Akron, Ohio, carrying out special investigations and developments on the electrodeposition of rubber. He was formerly a member of the research laboratory staff of the Eastman Kodak Co., Rochester, N. Y.

F. JAEGER has resigned from the United States Metal Refining Co., Carteret, N. J., to accept an appointment as associate chemist at the Government naval powder works at Indian Head, Md.

WILLIAM W. DOHANY has been appointed secretary of the Michigan Sand Lime Brick Association, with offices in the Penobscot Building, Detroit.

O. F. T. OLSEN, a graduate in chemistry from the Royal Technical College, Copenhagen, Denmark, and Fellow of the American Scandinavian Foundation, has arrived in the United States and will spend several months at the mill of the Nekoosa-Edwards Paper Co., Port Edwards, Wis.

Dr. SIDNEY D. WELLS, for a number of years in charge of the Forest Products Laboratory of the United States Department of Agriculture, Madison, Wis., has become director of the chemical and research divisions of the Stewart Inso Board Co., St. Joseph, Mo., manufacturer of special insulating materials.

ROBERT B. WOLF, whose pulp bleaching process was mentioned in the April issue, is president of the Pulp Bleaching Corporation and is a member of the engineering firm of Wolf and Hill, both of New York City. After graduating from the University of Delaware in 1896, Mr. Wolf began his long career in the pulp and paper industry as a workman. From this modest start he became successively superintendent of the Piercefield mill of the International Paper Co.; superintendent of the Hudson Falls mill of the Union Bag & Paper Co.; manager of manufacturing of the Burgess Sulphite Fibre Co.; general manager of the Spanish River Pulp & Paper Mills, Ltd.; staff assistant to Vice-President Charles Piez of the Emergency Fleet Corporation. In 1919 Mr. Wolf returned to the pulp and paper industry and organized The R. B. Wolf Co., which later became the firm of Wolf and Hill. Included in Mr. Wolf's technical achievements are a method of making sulphurous acid; the recovery of sulphur in the sulphite pulp process; a new method for making liquid sulphur dioxide; and a new process for pulp bleaching at high densities.

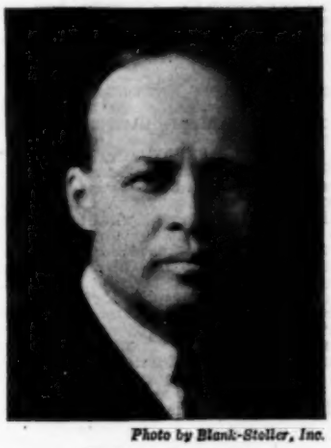


Photo by Blank-Stoller, Inc.

Robert B. Wolf

FRED W. SCHROEDER is with the refractories division of the Corning Glass Works, Corning, N. Y. He was formerly at the Tucson, Ariz., station of the United States Bureau of Mines.

C. E. ADAMS, president of the Air Reduction Co., New York, has been elected chairman of the board of the U. S. Industrial Alcohol Co.

W. L. DETHLOFF has resigned as general manager of the American Mond Nickel Co., Clearfield, Pa., and is succeeded by H. R. Condon.

R. A. WIGHT, chemical engineer, has been assigned to the investigation provided by the American Gas Association at the American Institute of Baking to collect basic facts relating to oven problems. MALCOLM REESER of the Institute staff represents the Institute in carrying on the studies.

BERNARD L. MCNULTY has been elected president of the New England Lime Company, succeeding the late J. King McLanahan, Jr. This selection indicates close co-ordination of activities of the New England company with those of its associated concern, the Marblehead Lime Company, of which latter Mr. McNulty retains the presidency.

FRANK C. WHITMORE, chairman of the chemistry department at Northwestern University, is to be on sabbatical leave during 1927-1928. He will spend the year in Washington as chairman of the Division of Chemistry and Chemical Technology of the National Research Council. He has also been appointed a member of the Central Petroleum Committee of the National Research Council and the American Petroleum Institute. This committee has charge of the research funds donated by John D. Rockefeller and by the Universal Oil Products Co.

LOUIS F. VOGT of Pittsburgh, recently of the Koppers Co. and former manager of the Standard Chemical Company, is now manager of the Warners plant of the American Cyanamid Company in New Jersey, mailing address Linden N. J.

F. G. COTTRELL is to receive an honorary doctorate at the commencement of the University of California the latter part of this month.

Dr. CHARLES L. REESE of E. I. du Pont de Nemours and Co. has gone abroad for a few weeks.

J. A. SINGMASTER, general manager of the technical department and F. G. BREYER, chief of research, resigned their positions with the New Jersey Zinc Co. and have opened a consulting office at 1640 Graybar Bldg., 420 Lexington Ave., New York, N. Y.

C. M. BOUTON, in charge of the physical laboratory of the Bureau of Mines Experiment Station, Pittsburgh, has resigned to take up work in the research laboratory of the Union Switch and Signal Co., Swissdale, Pa., a subsidiary of the Westinghouse Air Brake Co.

LESTER A. PRATT, director of research of the Merrimac Chemical Co. has been appointed manager of the Anderson Chemical Company division of his corporation.

ALCAN and MAX HIRSCH, R. F. BACON and M. C. WHITAKER have opened their new offices at 271 Madison Ave., New York, where they will continue their respective practices as chemical engineers.

GUSTAVE T. REICH, formerly manager of the Crystal Chemical Co. and later with its successors, the U. S. Industrial Alcohol Co. of Anaheim, Calif., has resigned to devote his time to personal business.

Dr. CHARLES A. KRAUS, research professor of chemistry at Brown University, will offer two lecture courses at

Western Reserve University, Cleveland, Summer session from June 20 to July 29.

ARTHUR W. EATON, president and founder of the Eaton, Crane & Pike Co., paper manufacturers of Pittsfield, Mass. has retired as president of the company and has been elected chairman of the Board of Directors. William H. Eaton, formerly vice-president will succeed his father as president.

Obituary

HUDSON MAXIM, the first to make smokeless powder in the United States and for many years one of the world's noted inventors and explosives experts, died May 6 at his home in Maxim Park, Lake Hopatcong, N. J. Mr. Maxim had been ill of anaemia for several years. The younger son of Isaac and Harriet Stevens Maxim, he was born at Orneville, Me., on February 3, 1853. His father was a country miller of extraordinary intellectual gifts and from him the boy received far more mind than money. In childhood he received practically no education. At 25 years of age he was able to complete his academic studies at the Maine Wesleyan Seminary. For many years Mr. Maxim was associated with E. I. du Pont de Nemours and Co. and also with the E. W. Bliss Co. of New York. He was the author of a number of books, including "The Science of Poetry and the Philosophy of Language," "Defenseless America," "Dynamite Stories," etc. He is survived by his widow and a son, H. D. Maxim.

CARL SCHOTT FOGH who has been in charge of the Wedge furnace design and engineering for the Bethlehem Foundry and Machine Co. since 1924, died of heart failure at Salt Lake City, March 10, at the age of 66.

Industrial Notes

THE HEVI DUTY ELECTRIC CO., Milwaukee,, Wis., has appointed the Louis C. Eitzen Co., 280 Broadway, New York City, as its Eastern sales representatives. R. L. Fearn is affiliated with the Eitzen Co. as its specialist on industrial electric furnaces.

THE CHICAGO PNEUMATIC TOOL CO., New York, announces the closing of its own offices in Dallas and Houston, Texas, incident to the appointment of Whealton & Townsend, Inc., with main offices at 120 East Brady St., Tulsa, Okla., as distributors of Chicago pneumatic products in the state of Texas east of meridian 102. Whealton & Townsend, Inc., will maintain sales and service offices in both Dallas and Houston.

THE BROWN INSTRUMENT CO., has established a branch office at 794 Ellicott Square Bldg., Buffalo, N. Y., with D. C. Mayne, as district manager.

THE SHEPARD ELECTRIC CRANE & HOIST CO., Montour Falls, N. Y., desiring a closer co-ordination of its motor supply with its electric crane and hoist business, has appointed Fred G. Bell to direct this new development. Mr. Bell was formerly president and general manager of the Zobell Electric Motor Corp., Garwood, N. J.

THE SHARPLES SOLVENTS CORP., of Philadelphia, manufacturers of pentasol (pure amyl alcohol) and pent-acetate (pure amyl acetate) announces the appointment of Chemical Solvents, Inc., Rolland H. French, president, 297 Fourth Ave., New York, as its exclusive Eastern sales agent.

THE SULLIVAN MACHINERY CO., Chicago, makes the following announcements: O. J. Neslage of the St. Louis office sales staff, formerly in the Joplin, Mo., district, has been appointed local manager at Mexico City, Edificio Oliver No. 3; A. W. Oakes, for several years past manager at Mexico City, has been assigned to a post in the United States; C. W. Miller has been appointed special representative in Cuba and will co-operate with the company's general agents for Cuba. The Purdy and Henderson Trading Co., Habana 55, esquina a Empedrado, Havana, Cuba; Matt Brodie, manager for Asia, sailed last week from San Francisco for Tokyo, following a three months furlough in this country.

THE CHAIN BELT CO., Milwaukee, Wis., announces that Geo. M. Dyke, who for some time has been assistant secretary of the company, has been appointed treasurer of the Stearns Conveyor Co., at Cleveland, Ohio, which some time ago was taken over by the Chain Belt Co.

THE FOOTE BROS. GEAR & MACHINE CO., Chicago, Ill., has added the following concerns as distributors of its products: The Interstate Machinery and Supply Co., 1006 Douglas St., Ohama, Neb., for Omaha, the eastern half of the State of Nebraska and the west portion of Iowa; W. L. Hutcheson, 201 E. California St., Oklahoma City, Okla., for Oklahoma City and the northern half of the State of Oklahoma; Nashville Machine & Supply Co., 123-135 Third Ave., North Nashville, Tenn., for Nashville and the central part of the State of Tennessee; Hollis & Co., 305-11 E. Markham St., Little Rock, Ark., for the city of Little Rock and vicinity.

THE LINK-BELT CO., Chicago, has opened a new sales office at 29 Brown-Marx Bldg., Birmingham, Ala., under the management of W. H. Norton.

THE COMBUSTION ENGINEERING CORPORATION, New York, announces the consolidation of its Cleveland district office with that of the Ladd Water Boiler Co. and Heine Boiler Co. at 1107 Guardian Building. The Philadelphia office of the three companies is at 807 Bankers Trust Building.

THE POWER SPECIALTY CO. announces the establishment of a new Canadian company which will concentrate on the manufacture of power plant equipment, and which has purchased the plant of the former Engineering and Machine Works of Canada, Ltd., at St. Catharines, Ontario. The new corporation will be known as the Canadian Power Specialty Co., Ltd., with main office at the works, and sales offices in Ottawa, Toronto, Montreal, Moncton and North Bay. A branch office of the Power Specialty Company has recently been opened at Atlanta, Ga., located at 315 Bona Allen Bldg., in charge of J. W. Lea.

JENKINS BROS. announce the retirement of Arthur C. Langston, who has been associated with them for thirty years, and the appointment of Joseph E. Hodgkins as manager and Anthony D. Weber, as assistant manager, in charge of its New England branch, with headquarters at 524 Atlantic Ave., Boston.

THE AMERICAN GAS ASSOCIATION now has its headquarters office at 420 Lexington Ave., New York City.

THE BROWN INSTRUMENT CO. has opened a Cincinnati branch at 718 First National Bank Building. J. R. Green is district manager.

A new BAILEY METER COMPANY has been formed and announces that it acquired the flow meter business of the General Electric Company and the fluid meter and combustion control business of the former Bailey Meter Co., with its factory and general offices in Cleveland, Ohio.

DR. EDWARD G. ACHESON has moved his New York office to 689 Fifth Avenue.

THE CELITE PRODUCTS CO. has appointed Col. H. C. Boyden to lecture on the results of recent investigations carried on to determine the workability of different concrete mixtures and the effect which this factor has upon the quality, cost and appearance of concrete for structures of all kinds. His talks are being presented principally to engineering societies and associations, engineering colleges, general clubs and other organizations.

THE HERCULES POWDER CO. has appointed F. V. Gunn & Co. of Richmond, Va., as distributors of steam-distilled wood turpentine, pine oil and wood resin in Richmond and vicinity.

THE LINCOLN ELECTRIC CO. of Cleveland announces the appointment of Royal D. Malm as western district sales manager with headquarters at Chicago.

JOHN MORRIS WEISS and CHARLES RAYMOND DOWNS, announce that their partnership activities as consulting chemists and chemical engineers will be carried on in corporate form under the name of Weiss and Downs, Inc. The same personal services of both individuals are available as heretofore.

THE QUIGLEY FURNACE SPECIALTIES CO., New York, announces the appointment of Harrison W. Wood, as a service man to cover the Central, South and South Atlantic States. His headquarters will be in Atlanta.

THE WILLIAM GANSCHOW CO. of Chicago, and Peoria announces the appointment of Fred E. Holtz as representative in the Milwaukee territory. The division headquarters will be located at 1246 24th Ave., Milwaukee, Wis.

THE PREST-O-LITE CO. announces the sale of the storage battery branch of its business to a new company, Prest-O-Lite Storage Battery Corporation. The entire capital stock of the purchasing company is owned by the Automotive Battery Corporation of New York. The Prest-O-Lite Co., Inc., will continue the manufacture and sale of acetylene gas for use in the oxy-acetylene process of welding and cutting metals, automobile lighting, lead burning, etc.

THE MERCO NORDSTROM VALVE CO. has moved its New York office to 11 West 42nd St.

THE AJAX METAL COMPANY, Philadelphia, has purchased the Foley Furnace Company, which company owns a number of electric furnace patents.

THE HOMESTEAD VALVE MANUFACTURING CO., INC., Homestead, Pa., announces the appointment of the Ziegler-White Company, 155 Second St., San Francisco, Calif., as the exclusive representative of this company in San Francisco and the surrounding territory.

The Refractory Division of THE CARBORUNDUM COMPANY at Perth Amboy, N. J., announces the completion of a motion picture production which tells the story of the manufacture and uses of carborundum refractories. The film shows Dr. E. G. Acheson reproducing his original experiment in which the first carborundum was made, and follows with present production in the giant electric furnace at Niagara Falls and the various processes of manufacturing carborundum refractory products. The film is now available, and can be secured by applying to the Carborundum Co., Refractory Division, Perth Amboy, N. J. Arrangements can be made for a speaker to present the film, and to supplement the film story with added information on the refractory problem in general.

CHEMICAL APPLIANCES, INC., can be addressed hereafter at 420 Lexington Ave., New York, N. Y.

DAYTON-DOWD CO., Quincy, Ill., announces the opening of a new sales office for the Carolinas, in charge of the Murphey Equipment Co., 212 Wilder Building, Charlotte, N. C. William S. Murphey is district manager.

FAIRBANKS, MORSE & Co. of Chicago has taken over the scale business of The Fairbanks Co. of New York. At an annual meeting W. S. Hovey was elected president, the former president, C. H. Morse, becoming chairman of the board.

Calendar

AMERICAN CHEMICAL SOCIETY, Detroit, Mich., Sept. 5 to 10.

AMERICAN ELECTROCHEMICAL SOCIETY, Northwestern trip, visiting industrial plants at Minneapolis, Butte, Anaconda, Wallace, Kellogg, Spokane, Seattle, Vancouver, Great Falls, Omaha and Keokuk, Sept. 4-20.

AMERICAN GAS ASSN., Detroit, May 31-June 1.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, Cleveland, Ohio, May 31, June 1, 2, 3.

AMERICAN IRON & STEEL INSTITUTE, Hotel Commodore, N. Y., May 20.

AMERICAN LEATHER CHEMISTS ASSN., annual meeting, Cincinnati, Ohio, June 15, 16 and 17.

AMERICAN OIL CHEMISTS' SOCIETY, New Orleans, June 20-21.

AMERICAN REFRACTORIES INSTITUTE, Spring meeting, Atlantic City, N. J., May 18 and 19.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS, spring meeting, White Sulphur Springs, W. Va., May 23 to 26.

AMERICAN SOCIETY FOR STEEL TREATING, Milwaukee, Wis., May 19 and 20.

AMERICAN SOCIETY FOR TESTING MATERIALS, French Lick, Ind., June 20 to 24.

NATIONAL COLLOID SYMPOSIUM, Ann Arbor, Mich., June 22 to 24.

NATIONAL EXPOSITION OF CHEMICAL INDUSTRIES, (11th) Grand Central Palace, New York, Sept. 26-Oct. 1.

NATIONAL FERTILIZER ASSN., White Sulphur Springs, June 6-9.

NATIONAL LIME ASSN., White Sulphur Springs, W. Va., May 17, 18 and 19.

Market Conditions and Price Trends

Nitrocellulose Varnishes and Lacquers Register Large Gains

Production More Than Doubled Last Year—Smaller Output Reported for Ready-Mixed Paints

MARKED increases in the production of nitrocellulose varnishes and lacquers featured operations in the paint and varnish industry last year. The rapid increase in production and consumption of these products may be understood from the fact that the output in 1925 was more than three times larger than the total for 1924 and in 1926, production was more than twice that reported for 1925. Wider classification is given in the totals for 1926 and the figures for that year include 7,705,300 gal. of nitrocellulose thinners.

The Department of Commerce reports that, according to data collected at the latest semiannual canvass of paint and varnish manufacturers, the production during the six-months period from July 1 to December 31, 1926, was as follows: 212,536,900 lb. of paste paints, comprising 128,930,900 lb. of pure white lead in oil, 14,535,300 lb. of combination or graded whites, 4,362,500 lb. of zinc oxide in oil, and 64,707,900 lb. of other paste paints; 45,623,000 gal. of ready-mixed and semipaste paints, including enamels; 36,242,900 gal. of varnishes, japans, and lacquers, other than pyroxylin; 12,843,600 gal. of pyroxylin (nitrocellulose) varnishes or lacquers; and allied products comprising paint and varnish removers, 413,100 gal.; stains (not varnish stains) 2,159,800 gal.; liquid fillers, 376,900 gal.; paste fillers, 7,515,900 lb.; and putty, 30,837,400 lb.

The statistics for paints and varnishes for the second half of 1926 as compared with the first half of that year show increases of 1.7 per cent and one-half of 1 per cent, respectively, for paste paints and ready-mixed and semipaste paints, including enamels, a decrease of 4.8 per cent for varnishes, japans, and lacquers, other than pyroxylin, and an increase of 26.7 per cent for pyroxylin varnishes or lacquers.

Establishments Reporting

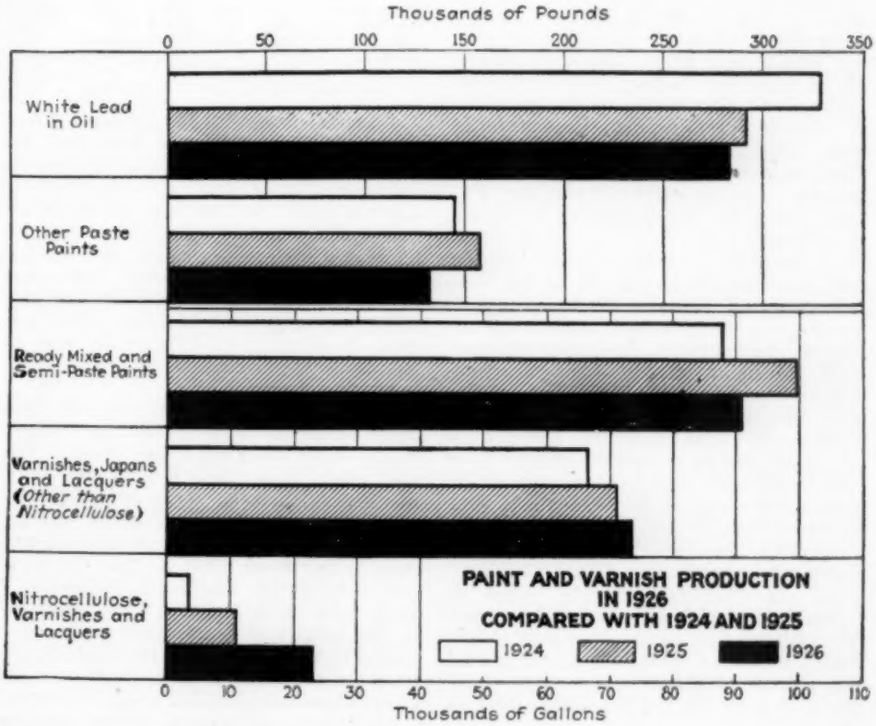
The statistics for the sceond half of 1926 are based on returns from 581 establishments, of which 76 reported the manufacture of pure white lead in oil; 157, combination or graded whites; 137, zinc oxide in oil; 325, other paste paints; 435, ready-mixed and semipaste paints; 372, varnishes, japans, and lacquers, other than pyroxylin; and 138, pyroxylin varnishes or lacquers.

No data are included for 31 establishments which reported for the first half of 1926 but not for the last half. These establishments reported for the first half of 1926 six-tenths of 1 per cent of the total quantity of paste paints; 2 per cent of the ready-mixed and semipaste paints, including enamels, 1.3 per cent of the varnishes, japans, or lacquers, other than pyroxylin, and three-tenths of 1 per cent of the pyroxylin varnishes or lacquers.

In the following table data will be found covering production, sales, and distribution for calendar year 1926, together with comparisons for 1925 and 1924:

Production of Paint and Varnish—1924, 1925 and 1926

	Total Production	Establishments Reporting Sales: Total Sales	Industrial	Trade Sales and Others	Not Classified
Paste Paints					
1924—lb.	487,611,000	396,549,200	45,566,900	339,827,200	12,136,100
1925—lb.	465,285,400	363,654,100	53,880,900	292,038,600	17,734,600
1926—lb.	421,559,700	341,284,300	44,411,400	278,294,200	18,578,700
White Lead in Oil, Pure					
1924—lb.	329,811,700	310,887,700	13,649,200	291,610,600	5,577,900
1925—lb.	293,041,800	270,672,200	18,629,300	240,832,800	11,210,100
1926—lb.	258,274,700	247,316,300	11,425,400	226,892,600	8,998,300
Zinc Oxide in Oil					
1924—lb.	11,921,600	9,212,700	982,600	7,937,300	292,700
1925—lb.	13,631,300	9,824,800	816,500	8,450,300	558,000
1926—lb.	7,865,000	5,582,600	691,800	3,580,200	1,110,600
Other Paste Paints					
1924—lb.	145,877,700	76,439,800	29,935,100	40,234,300	6,265,400
1925—lb.	158,612,300	83,157,100	34,435,100	42,755,500	5,966,500
1926—lb.	129,249,700	72,367,500	29,138,500	36,713,600	6,515,400
Ready-Mixed and Semi-Paste Paints, including Wall Paints and Enamels					
1924—gal.	88,274,100	62,459,400	21,110,700	35,412,500	5,551,900
1925—gal.	99,709,000	74,224,700	23,256,300	43,920,300	7,048,100
1926—gal.	91,025,100	73,562,600	25,993,400	37,442,100	10,127,100
Varnishes, Japans and Lacquers, other than Nitrocellulose					
1924—gal.	66,859,400	42,657,100	23,700,400	15,442,400	3,514,300
1925—gal.	70,913,400	43,567,900	25,687,100	14,660,600	3,220,200
1926—gal.	74,324,300	53,638,900	29,577,900	19,315,800	4,407,800
Nitrocellulose Varnishes, Lacquers and Products					
1924—gal.	3,591,000	2,853,500	1,952,100	441,300	460,200
1925—gal.	11,103,400	10,029,200	8,373,400	1,071,200	584,600
1926—gal.	23,980,400	20,089,800	13,219,800	3,708,000	2,162,000



Market Conditions and Price Trends

Production of Chemicals Continues to Gain in Volume

Active Operations Among Large Consuming Industries Causes Steady Withdrawals from Producing Centers

PRODUCTION of raw materials in March was larger than in either the preceding month or in March, 1926. Increases were registered over both prior periods in all groups except crop marketings, which were lower than in February, and forestry production which was lower than in March of last year. According to reports of the Department of Commerce, manufacturing production, after adjustment for differences in working time, reached a very high level in March, showing a gain of 3 per cent over March, 1926. All industrial groups, making no allowance for differences in working time, showed larger output than in February. As compared with a year ago, industrial production was greater in all groups except nonferrous metals, lumber, paper and printing, and automobiles, each of which declined.

While production of paper and printing declined in March, the output of chemical wood pulp was 239,698 tons compared with 213,120 tons in February and 235,684 tons in March, 1926. Orders for water softeners were 968 units in March, 704 units in February and 941 units in March, 1926. Statistics on paint and varnish are lacking but private estimates credit increases in output. Production of gasoline in March totaled 27,886,000 bbl. compared with 25,024,000 bbl. in February and 23,868,000 bbl. in March, 1926. Production of vegetable oils for the first quarter of the year more than doubled that for the corresponding period of 1926. Refined oil output increased in a like manner with an evident reflection in demand for chemicals used by refiners. That consumption of refined oils increased is apparent from the fact that production of oleomargarine in March accounted for 2,487,000 lb. of cottonseed oil as against 2,006,000 lb. in February and 2,347,000 lb. in March, 1926. Consumption of coconut oil in the oleomargarine trade was 11,169,000 lb. in March, 9,679,000 lb. in February, and 8,925,000 lb. in March, 1926. The textile and leather trades have been active and the expected lull in manufacture of automobile tires did not materialize although dealers are now reported to be carrying large stocks and the early buying this season points to a slower period ahead.

Reports on industrial activities in April also are encouraging. The *Electrical World* from reports based on consumption of power states that a new high record for production was established in that month with a gain of 4.1 per cent over March and a gain of 2.5 per cent over March, 1926, the previous record month.

Stocks of commodities held at the end of March, after adjustments for seasonal variations, were smaller than at the end of the preceding month but were larger than a year ago. All groups showed smaller inventories than at the end of February, except food stuffs, while as compared with the end of March, 1926, all groups reported larger stocks.

Unfilled orders for manufactured commodities, principally iron and steel, and building materials, showed an increase over the preceding month but were smaller than a year ago.

Indexes of Employment

Based on the weighted index of employment prepared by the Bureau of Labor, production of chemicals was larger in March than in February or March, 1926. Employment in the fertilizer industry increased about 29 per cent over February and it is a coincidence that reports from the fertilizer trade indicate a 27 per cent increase in sale of fertilizers in April. Indexes of employment offer the following comparisons in the industries which are large consumers of chemicals:

Indexes of Employment

	March 1927	Feb. 1927	March 1926
Dyeing and finishing textiles	100.0	99.4	101.6
Leather	92.9	94.7	93.4
Paper and pulp	94.3	94.5	95.6
Chemicals	96.9	96.3	95.4
Fertilizers	134.6	105.7	153.1
Petroleum refining	103.0	102.4	97.4
Glass	96.6	94.7	100.6
Automobile tires	105.9	104.3	111.8
All manufacturing	91.4	91.0	93.7

In connection with the indexes of employment it is worthy of note that the Department of Commerce has just announced that according to a study of figures from the censuses of manufactures, the quantity or physical volume of manufacturers produced per person engaged in manufacturing increased nearly 50 per cent from 1899 to 1925, reflecting a growth of nearly 180 per cent in quantity of production and of less than 90 per cent in total number of persons engaged.

Expansion in output per person has been particularly large during recent years, amounting to 10 per cent in the two years from 1923 to 1925 and to 40 per cent in the six years from 1919 to 1925. From 1899 to 1909 there was an increase of 10 per cent in production per person, but from 1909 to 1919 the output per person decreased. Comparisons with 1914 and 1921 are affected by the industrial depressions which prevailed in those years, as in times of depression curtailment in production generally exceeds reduction in employment.

Growth in output per person may be attributed to two factors: changes within individual industries and plants, and the shifts among industries. The first set of changes includes the increasing utilization of machinery and power, the introduction of various sorts of labor-saving devices and methods, the growth of mass production of standardized articles, the elimination of waste, the planning of production in relation to general business conditions, and other economies resulting from improvements in methods and management.

Lower Price Levels

The trend of values is still downward and while higher producing costs brought an upward revision in the denatured alcohol market during the month, this was more than offset by declines in miscellaneous chemicals and the weighted number settled at 112.95 as compared with 113.34 a month ago and 111.64 a year ago. Oils and fats also sold more in buyers' favor despite higher quotations for linseed oil. The weighted index number for oils and fats is now 129.97 compared with 131.67 in April and 154.49 in May, 1926.

Foreign Trade

During the first quarter of the current year the foreign trade of the United States in chemical and allied products was very favorable, according to the Chemicals Division. Exports advanced 13 per cent, from $40,332,000 in January-March, 1926, to $45,710,000 in January-March, 1927. Imports on the other hand, declined 23 per cent, from $68,321,000 to $52,803,000.

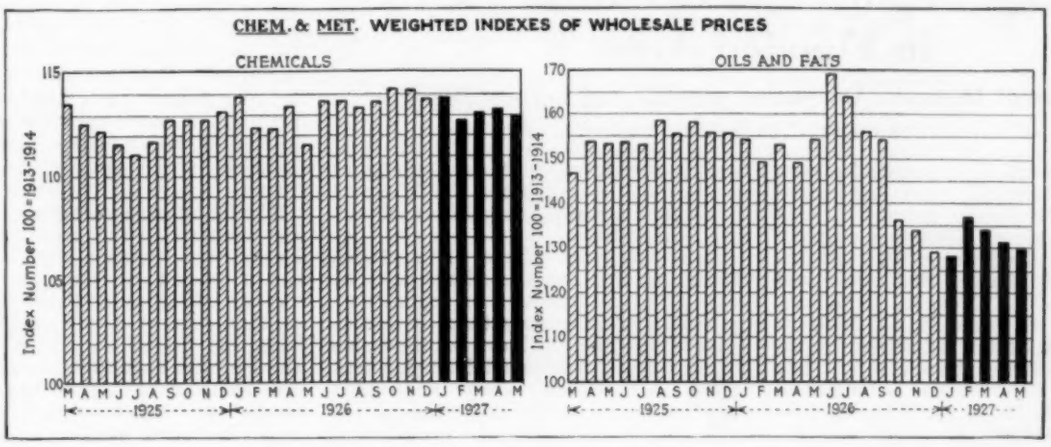
These figures show a decided change from the trade during the corresponding periods of previous years when exports were usually smaller and imports much heavier than in the later months of the year. The difference of $7,100,000 between exports and imports was also less than the usual variation between the foreign sales and purchases.

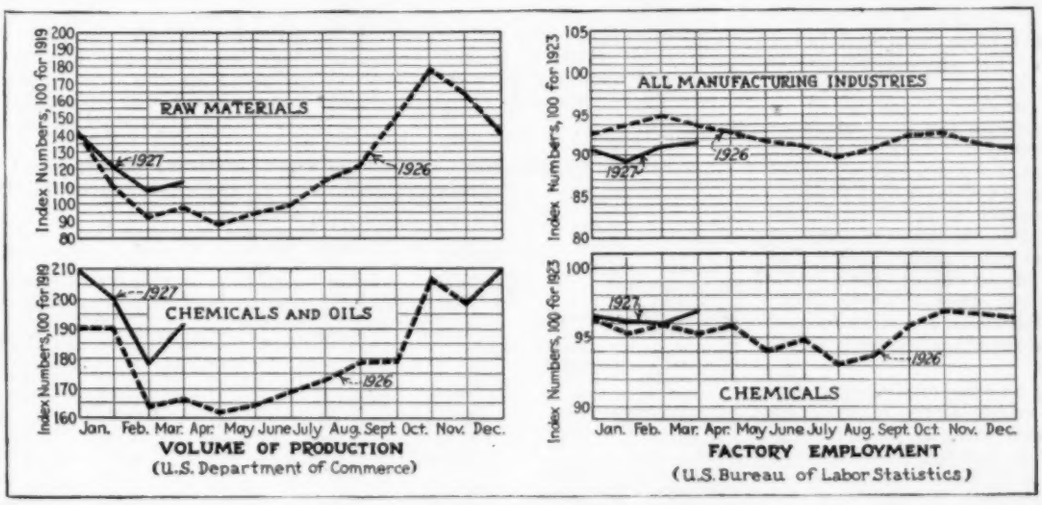
In the outward movement a large gain in sales of coal-tar products was the most important alteration. This was explained by shipments of crude coal-tar products, especially benzol and tar, and was undoubtedly the indirect result of the British coal strike of last autumn since the European consumers of these products have looked to the United States for a larger part of their supplies which formerly were furnished by England. England's purchases of American benzol also increased considerably, to say nothing of Germany's and the Netherland's orders, while France, which usually procures the bulk of its requisites of tar from England, purchased over 250,000 barrels, worth $1,354,000.

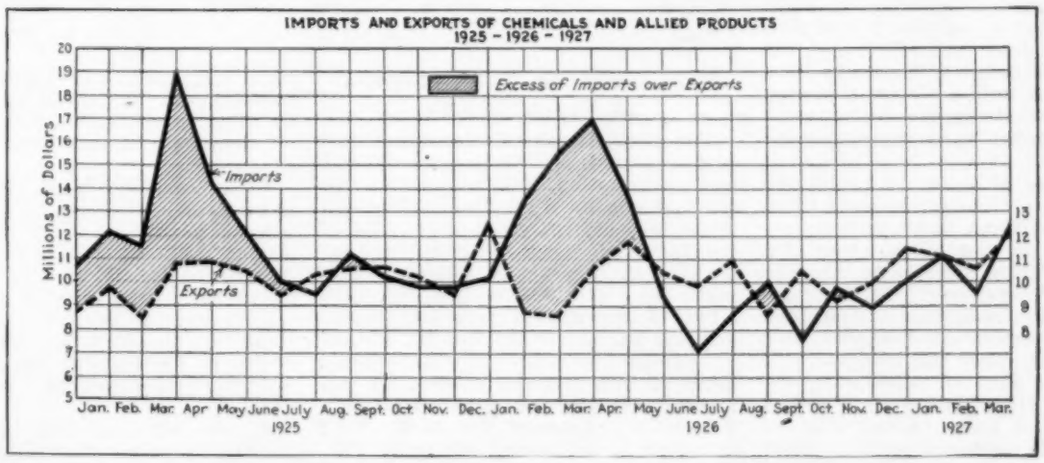
Exports of industrial chemicals during the first three months of 1927, amounting to $8,562,000, not only surpassed those of the corresponding quarter of 1926 by 15 per cent but also exceeded the imports of $7,503,000 by over $1,000,000.

CHEM·& MET· Statistics of Business

In the Chemical Engineering Industries







Market Conditions and Price Trends

Damage Reported to Chemical Plants in Flooded Area

Large Part of Domestic Output of Alcohol and Carbon Black Is Centered in Louisiana

CONSIDERABLE damage has been done to chemical plants in flooded areas along the Mississippi and there is imminent danger of additional destruction from the flood waters now mounting in the Arkansas, Red river and other tributaries. Monroe, Louisiana, the center of the carbon black industry of the United States, is being threatened by the rising backwaters. The twin town of West Monroe is inundated but heroic efforts in building up protective levees have so far saved the industrial plants and most of the homes in Monroe.

The carbon black industry of the district has not been operating at full capacity for some time and presumably the remainder of the plants will shortly cease operations until flood conditions have subsided. The threatened shortage in carbon black will be due either to closing of producing plants or to failure of transportation lines to function. The rubber tire industry has been greatly concerned by the situation as fears have been expressed that production of tires might suffer forced curtailment because of lack of carbon black. In some cases asking prices for prompt shipment of carbon black have been advanced but other producers have not revised quotations and have issued reassuring statements regarding existing conditions.

One plant to be completely wiped out as an indirect result of the flood is the Louisiana alcohol plant of the Rossville Company which had to be evacuated when the artificial break was made in the levee at Poydras, below New Orleans. As alcohol plants at New Orleans and vicinity produce more than one-third of the country's annual output, the situation is grave enough to cause apprehension relative to future supplies. Already an advance of 2½c. per gal. has gone into effect and the market undoubtedly will remain in a strong position until a clearer idea may be had as to what extent consuming demand must be met by plants outside the flooded area.

At the time of going to press, the point of greatest danger appears to be in Central Louisiana where the very recent breaks in the levee along the Bayou des Glaises threaten to inundate the so-called "sugar-bowl" district. According to the predictions of the flood relief headquarters at Memphis, this will eventually mean the inundation of a strip about 5 to 10 miles wide, extending south from Mansura and Naples through Grand Lake to the Gulf of Mexico. This territory contains most of the sugar plantations and mills of Louisiana and the loss to the sugar industry will be considerable. It will, however, automatically relieve the more thickly populated territory extending east to the Mississippi and should result in lower river stages at Baton Rouge and New Orleans.

Wood chemical plants in northern Mississippi and Louisiana have suffered more from interruption of operations by loss of wood supply than by actual damage to plants. Most of these industries draw their wood from farmers in the surrounding valleys and these supplies are no longer available.

There has been a slight curtailment of operations at the huge refinery at Baton Rouge due to the rising waters which have swept over the company's docks and made it difficult and in some cases impossible to unload the barges in which the crude oil is brought down the Mississippi. The refinery itself is so situated that it is not seriously threatened even though the river were to reach a considerably higher stage at this point.

Large Increase in Production of Vegetable Oils

The Department of Commerce has just reported on factory production and consumption of oils and fats for the first quarter of the year. The statistics are derived from a canvass of the industry. According to this report, production was as follows: Vegetable oils, 416,508,975 lb.; fish oils, 8,149,876 lb.; animal fats, 542,465,032 lb.; and grease, 89,953,684 lb.; a total of 1,057,077,567 lb. Of the several kinds of fats and oils covered by this inquiry, the greatest production, 415,930,980 lb., appears for lard. Next in order is cottonseed oil with 162,999,207 lb.; linseed oil with 145,328,656 lb.; tallow with 124,197,159 lb.; coconut oil with 64,406,590 lb., and corn oil with 27,486,783 lb.

The production of refined oils during the period was as follows: cottonseed, 190,113,979 lb.; coconut, 64,745,278 lb.; peanut, 1,936,828 lb.; corn, 25,918,665 lb.; soya-bean, 2,366,810 lb.; and palm-kernel, 4,249,250 lb. The quantity of crude oil used in the production of each of these refined oils is included in the figures of crude consumed.

The outstanding feature of the report consists in the large gain in production of vegetable oils in the three-month period as compared with the corresponding period of 1926. The greater part of the increase resulted from the larger supply of cottonseed aided by the fact that the crush in the last quarter of 1926 was relatively small. A very decided increase also was registered in the output of linseed oil and in the case of both cottonseed and linseed oil, consumption was larger than in the first quarter of last year.

Consumption figures likewise point to a material change in the trade in palm-kernel oil. In 1926 demand for that oil was the largest on record whereas in the first quarter of 1927, consumption was of negligible volume. As domestic production of palm-kernel oil is very small, the falling off in consumption is explained by conditions in primary markets which made this oil relatively dearer than competing products.

China wood oil went into consumption in smaller volume because of high prices brought about by internal conditions in China. It is probable that figures for consumption of China wood oil in the second quarter of this year will prove more unfavorable than those for the first quarter as buying orders in April and in the first half of May were reported to have been reduced.

In the accompanying table will be found data on production, consumption and stocks of vegetable oils for the quarter ended March 31, 1927, together with comparisons for the first quarter of 1926.

Production, Consumption, and Stocks of Vegetable Oils for Quarter Ended March 31

	1927			1926		
Kind	Production	Consumption	Factory and Warehouse Stocks March 31	Production	Consumption	Factory and Warehouse Stocks June 30
Vegetable Oils (1)	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.
Cottonseed, crude	640,289,910	638,487,997	140,308,610	162,999,207	237,748,067	15,406,020
Cottonseed, refined	577,830,501	342,228,797	502,593,484	190,113,979	248,364,167	191,741,402
Peanut, virgin and crude	2,446,146	2,539,930	1,889,022	3,093,372	2,332,077	1,063006
Peanut, refined	2,124,740	1,800,684	767,740	1,936,828	1,973,638	1,110,742
Coconut, or copra, crude	72,567,978	129,479,109	92,659,586	64,406,590	105,151,692	65,796,487
Coconut, or, copra, refined	57,188,329	58,542,356	13,225,544	64,745,278	57,749,740	12,372,145
Corn, crude	27,273,591	28,853,605	8,528,794	27,486,783	30,594,000	6,868,496
Corn, refined	22,147,348	4,868,036	10,094,843	25,918,665	7,246,302	11,065,480
Soya-bean, crude	861,577	2,168,885	3,847,798	873,902	5,517,420	4,965,232
Soya-bean, refined	840,378	1,036,890	1,687,647	2,366,810	2,048,426	2,429,861
Olive, edible	338,551	340,535	4,486,641	21,351	623,487	8,118,491
Olive, inedible	17,832	1,365,934	2,207,095	685	3,017,320	3,759,765
Sulphur oil, or olive foots	.....	8,093,216	4,189,200	.....	9,438,247	8,230,607
Palm-kernel, crude	.....	481,639	550,363	.....	32,844,911	12,796,219
Palm-kernel, refined	126,130	48,850	56,538	4,249,250	2,587,460	1,825,589
Rapeseed	.....	3,412,647	4,276,740	89,180	3,623,570	3,624,596
Linseed	202,162,304	109,673,932	206,318,946	145,328,656	107,200,211	128,556,548
Chinese wood or tung	.....	20,622,439	13,841,771	.....	22,448,035	19,890,464
Chinese vegetable tallow	.....	776,887	2,094,277	.....	1,224,722	840,520
Castor	14,049,283	4,840,111	6,624,143	11,447,480	4,424,685	7,343,230
Palm	.....	21,847,840	14,922,929	.....	28,486,691	28,632,933
All other	349,728	1,995,644	4,454,570	761,789	2,073,995	5,522,962
Totals	1,620,634,426	1,383,505,963		705,839,793	916,748,863	

Market Conditions and Price Trends

Chem. & Met. Weighted Index of Chemical Prices

Base = 100 for 1913-14

This month	**112.95**
Last month	113.34
May, 1926	111.64
May, 1925	112.24

Lower values ruled during the month for lead oxides, acetate of lead, tin, salts, benzol and phenol. The only important advance in price was the 2½c per gal. rise in quotations for denatured alcohol.

Falling Off in Production of Sulphuric Acid

While there was a very appreciable increase in sales of fertilizer in the southern states in April, tag sales having been 29 per cent larger than in April, 1926, total sales for the present season, December to April inclusive, amounted to 3,836,160 short tons, as compared with 4,518,482 short tons for the corresponding period of the preceding season. This represents a decrease of more than 15 per cent for the period.

As the fertilizer trade is the largest consumer of sulphuric acid it is evident that any radical change in that industry will find more or less proportionate reaction in production and consumption of sulphuric acid. Other industries which offer consuming outlets for sulphuric acid have been operating in an active way so far this year and consumption in those lines will compare favorably with that for the corresponding period of 1926.

In the fertilizer industry, however, production of sulphuric acid appears to have fallen off to an even greater extent than is indicated by the decline in sales of fertilizer. It is reported by the National Fertilizer Association that production of acid phosphate for the first quarter of this year was more than 20 per cent below the total for the Jan.-March period of 1926. Possibly the greater activities during April will bring this comparison close to the 15 per cent decline as reported for sales of fertilizer.

Assuming sulphuric acid manufacture within the fertilizer industry will continue for the first half of the year on a basis of 15 per cent below the level maintained in 1926, total production for Jan.-June, 1927, would amount to 795,118 tons, as compared with an output of 935,433 tons in Jan.-June, 1926.

Production of sulphuric acid in the fertilizer industry for the second half of 1926 is shown in the accompanying table. Consumption and stocks also are included as well as comparisons with the first half of 1926 and the second half of 1925.

Production and Consumption of Sulphuric Acid in Fertilizer Industry

	1926		1925	Per Cent of Increase or Decrease
United States	2nd Half July-Dec. Tons	1st Half Jan.-June Tons	2nd Half July-Dec. Tons	2nd Half 1925 to 2nd Half 1926
Stocks on hand at beginning of period	86,247	101,416	104,376	—17.4
Produced in establishments reporting	810,326	935,433	955,084	—15.2
Purchased	413,836	378,415	435,210	— 4.9
Total	1,310,409	1,415,264	1,494,670	—12.3
Consumed in making fertilizers	972,806	1,085,877	1,122,025	—13.3
Sales:				
To fertilizer works	155,079	151,232	181,368	—14.5
To other than fertilizer works	89,393	94,761	90,815	— 1.6
Stocks on hand at end of period	93,131	83,394	100,462	— 7.3
Southern District				
Stocks on hand at beginning of period	43,727	49,624	59,093	—26.0
Produced in establishments reporting	446,139	522,705	544,194	—18.0
Purchased	240,197	198,889	254,153	— 5.5
Total	730,063	771,218	857,440	—14.9
Consumed in making fertilizers	547,922	614,667	669,718	—18.2
Sales:				
To fertilizer works	103,101	77,543	95,334	+8.1
To other than fertilizer works	35,484	34,315	41,584	—14.7
Stocks on hand at end of period	43,556	44,693	50,804	—14.3
Northern and Western Districts				
Stocks on hand at beginning of period	42,520	51,792	45,283	— 6.1
Produced in establishments reporting	364,187	412,728	410,890	—11.4
Purchased	173,639	179,526	181,057	— 4.1
Total	580,346	644,046	637,230	— 8.9
Consumed in making fertilizers	424,884	471,210	452,307	— 6.1
Sales:				
To fertilizer works	51,978	73,689	86,034	—39.6
To other than fertilizer works	53,909	60,446	49,231	+9.5
Stocks on hand at end of period	49,575	38,701	49,658	— 0.2

The Department of Commerce announces that, according to data collected at its recent semi-annual canvass, fertilizer manufacturers during the last half of 1926 produced 810,326 tons of sulphuric acid and consumed 972,806 tons in the manufacture of 1,805,691 tons of acid phosphates containing 30,613,000 units, of 20 lbs. of available phosphoric acid. The production of sulphuric acid by fertilizer manufacturers was thus equal to 83.3 per cent of their total consumption. Acid phosphates sold as such amounted to 649,864 tons, containing 11,329,000 units of available phosphoric acid; and 319,800 tons of acid phosphates, containing 5,455,000 units, were consumed in the manufacture of other fertilizers.

The statistics for the last half of 1926, as compared with those for the last half of 1925, show decreases of 11.8 per cent in production of acid phosphates and 11.1 per cent in total sales of acid phosphates, a decrease of 7.3 per cent in stocks of sulphuric acid on hand at the end of the period, and an increase of 6.2 per cent in stocks of acid phosphates.

Chem. & Met. Weighted Index of Prices for Oils and Fats

Base = 100 for 1913-14

This month	**129.97**
Last month	131.67
May, 1926	154.49
May, 1925	153.87

The unusually high prices reached last month for spot china wood oil were not maintained and the tone throughout the general oil market was unchanged to lower with the exception of linseed oil which advanced under higher costs for flaxseed.

Imports of Chemicals

	March 1927	March 1926
Dead or creosote oil, gal.	7,519,746	5,038,402
Pyridine, lb.	.....	62,166
Coal-tar acids, lb.	230	95,277
Coal-tar intermediates, lb.	248,059	22,307
Arsenic, lb.	1,689,377	747,872
Acid, citric, lb.	44,800	11,200
Acid, formic, lb.	180,672	343,324
Acid, oxalic, lb.	95,842	121,447
Acid, sulphuric, lb.	1,533,562	5,261,107
Acid, tartaric, lb.	374,337	136,948
Ammonium chloride, lb.	1,455,736	1,312,446
Ammonium nitrate, lb.	1,015,334	1,001,644
Barium compounds, lb.	763,108	2,436,229
Calcium carbide, lb.	574,500	2,340,710
Cobalt oxide, lb.	36,000	28,943
Copper sulphate, lb.	54,213	168,000
Bleaching powder, lb.	193,697	744,205
Lime, citrate, lb.	55,667	278,161
Glycerin, crude, lb.	1,149,795	2,574,038
Glycerin, refined, lb.	146,286	728,828
Magnesium compounds, lb.	1,570,728	3,528,840
Potassium cyanide, lb.	14,827	3,816
Potassium carbonate, lb.	1,900,791	953,990
Potassium nitrate, tons	88	504
Caustic potash, lb	1,977,363	1,510,281
Cream of tartar, lb.	22,445	38,079
Potassium chlorate, lb.	1,463,293	1,608,425
Sodium cyanide, lb.	4,098,048	3,068,243
Sodium ferrocyanide, lb.	221,214	156,179
Sodium nitrate, lb.	47,461	503,651
Sodium nitrite, tons	94,151	181,238
Sulphate of ammonia, tons	760	1,730

Exports of Chemicals

	March 1927	March 1926
Benzol, lb.	3,016,972	11,836
Crude coal-tar and pitch, bbl.	115,630	6,741
Acid, sulphuric, lb.	420,361	1,324,657
Other acids, lb.	1,583,731	2,151,298
Methanol, gal.	20,584	62,139
Ammonia and compounds, lb.	350,235	361,560
Aluminum sulphate, lb.	3,668,040	3,655,135
Acetate of lime, lb.	1,587,652	2,255,888
Calcium carbide, lb.	346,541	402,017
Bleaching powder, lb.	747,375	1,351,393
Copper sulphate, lb.	411,655	368,033
Formaldehyde, lb.	173,179	140,190
Potassium compounds, lb.	198,560	284,469
Sodium bichromate, lb.	499,795	523,315
Sodium cyanide, lb.	124,713	135,106
Borax, lb.	4,449,733	2,265,649
Soda ash, lb.	2,393,039	2,805,673
Sodium silicate, lb.	4,200,145	4,319,754
Sal soda, lb.	989,928	1,292,067
Caustic soda, lb.	11,825,154	9,470,786
Bicarbonate of soda, lb.	1,620,829	2,321,818
Sulphate of ammonia, tons	12,102	10,856
Sulphur, tons	43,782	60,489

Current Prices in the New York Market

For Chemicals, Oils and Allied Products

The following prices refer to round lots in the New York Market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to May 16.

Industrial Chemicals

		Current Price	Last Month	Last Year
Acetone, drums	lb.	$0.12 -$0.13	$0.12 -$0.13	$0.12 -$0.13
Acid, acetic, 28%, bbl.	cwt.	3.38 - 3.63	3.38 - 3.63	3.25 - 3.50
Boric, bbl.	lb.	.08½- .08¾	.08½- .08¾	.08½- .11
Citric, kegs	lb.	.43½- .44½	.43½- .47	.45 - .47
Formic, bbl.	lb.	.10¾- .11	.10¾- .11	.10 - .10¾
Gallic, tech., bbl.	lb.	.50 - .55	.50 - .55	.45 - .50
Hydrofluoric 30% carb.	lb.	.06 - .07	.06 - .07	.06 - .07
Lactic, 44%, tech., light, bbl.	lb.	.13½- .14	.13½- .14	.13½- .14
22%, tech., light, bbl.	lb.	.06½- .07	.06½- .07	.06½- .07
Muriatic, 18°, tanks	cwt.	.85 - .90	.85 - .90	.80 - .85
Nitric, 36°, carboys	cwt.	.05 - .05¼	.05 - .05¼	.05 - .05¼
Oleum, tanks, wks.	ton	18.00 -20.00	18.00 -20.00	18.00- 20.00
Oxalic, crystals, bbl.	lb.	.11 - .11½	.11 - .11½	.10½- .11
Phosphoric, tech., c'bys.	lb.	.07 - .07½	.07 - .07½	.07½- .08
Sulphuric, 60°, tanks	ton	10.50 -11.00	10.50 -11.00	9.50 -10.00
Tannic, tech., bbl.	lb.	.35 - .40	.35 - .40	.45 - .50
Tartaric, powd., bbl.	lb.	.33 - .34	.33 - .34	.28 - .30
Tungstic, bbl.	lb.	1.00 - 1.20	1.00 - 1.20	1.00 - 1.20
Alcohol, ethyl, 190 p'f. U.S.P. bbl.	gal.	4.92½- 5.00	4.92½- 5.00	4.90 - 5.00
Alcohol, Butyl, dr.	lb.	19½- .20¼	.20 - .20¼	.18½- .19
Denatured, 190 proof No. 1 special dr.	gal.	.40 -.....	.37½- .39½	.28 -.....
No. 5, 188 proof, dr.	gal.	.40 -.....	.37½- .39½	.32 -.....
Alum, ammonia, lump, bbl.	lb.	.03½- .04	.03½- .04	.03½- .04
Chrome, bbl.	lb.	.05½- .05¾	.05½- .05¾	.05½- .06
Potash, lump, bbl.	lb.	.02½- .03¼	.02½- .03¼	.02½- .03¼
Aluminum sulphate, com., bags	cwt	1.40 - 1.45	1.40 - 1.45	1.40 - 1.45
Iron free, bg.	cwt	2.00 - 2.10	2.00 - 2.10	2.40 - 2.45
Aqua ammonia, 26°, drums	lb.	.02¾- .03	.02¾- .03¼	.03¼- .04
Ammonia, anhydrous, cyl.	lb.	.11 - .13	.11 - .15	.13 - .15
Ammonium carbonate, powd. tech., casks	lb.	.10¼- .14	.10¼- .14	.11 - .14
Sulphate, wks.	cwt	2.45 -.....	2.45 -.....	2.60 -.....
Amylacetate tech., drums	gal.	2.15 - 2.20	2.15 - 2.20	1.80 - 1.90
Antimony Oxide, bbl.	lb.	.15½- .17	.16½- .17	.14½- .15
Arsenic, white, powd., bbl.	lb.	.03½- .04¼	.03½- .04¼	.03½- .04¼
Red, powd., kegs	lb.	.10½- .11	.10½- .11	.12 - .12½
Barium carbonate, bbl.	ton	50.00 -52.00	47.00 -50.00	48.00 -50.00
Chloride, bbl.	ton	60.00 -65.00	57.00 -62.00	63.00 -65.00
Nitrate, cask	lb.	.08 - .08½	.07½- .08¼	.07½- .08
Blanc fixe, dry, bbl	lb.	.04 - .04½	.04 - .04½	.03½- .04
Bleaching powder, f.o.b., wks., drums	cwt.	2.00 - 2.10	2.00 - 2.10	2.00 - 2.10
Borax, bbl.	lb.	.04½- .04¾	.04¾- .05	.05 - .05½
Bromine, cs.	lb.	.45 - .47	.45 - .47	.45 - .47
Calcium acetate, bags	cwt	3.50 -.....	3.50 -.....	3.25 - 3.50
Arsenate, dr.	lb.	.06½- .08	.06½- .07	.06 - .07
Carbide drums	lb.	.05 - .06	.05½- .06	.05½- .06
Chloride, fused, dr., wks.	ton	21.00 -.....	21.00 -.....	21.00 -.....
Phosphate, bbl.	lb.	.07 - .07½	.07 - .07½	.07 - .07½
Carbon bisulphide, drums	lb.	.05½- .06	.05½- .06	.05½- .06
Tetrachloride drums	lb.	.06½- .07	.06½- .07	.06½- .06½
Chlorine, liquid, tanks, wks.	lb.	.04 - .04½	.04 - .04½	.04 - .04½
Cylinders	lb.	.05½- .08	.05½- .08	.05½- .08
Cobalt oxide, cans	lb.	2.00 - 2.10	2.00 - 2.10	2.10 - 2.25
Copperas, bgs., f.o.b. wks.	ton	14.00 -17.00	15.00- 16.00	15.00 -18.00
Copper carbonate, bbl.	lb.	.17 - .17½	.17 - .18	.16½- .17
Cyanide, tech., bbl.	lb.	.49 - .50	.49 - .50	.49 - .50
Sulphate, bbl.	cwt.	4.95 - 5.00	4.80 - 4.90	4.75 - 5.00
Cream of tartar, bbl.	lb.	.22 - .22½	.22 - .22½	.21 - .22
Epsom salt, dom., tech., bbl.	cwt.	1.75 - 2.15	1.75 - 2.00	1.75 - 2.00
Imp., tech., bags	cwt.	1.15 - 1.25	1.15 - 1.25	1.35 - 1.40
Ethyl acetate, 85% drums	gal.	.74 - .76	.74 - .76	.82 - .85
99%, dr.	gal.	.95 - .96	.95 - .96	1.03 - 1.08
Formaldehyde, 40%, bbl.	lb.	11½- .11¾	.11½- .11¾	.09 - .09½
Furfural, dr.	lb.	.15 - .17½	.15 - .17½	.17½- .20
Fusel oil, crude, drums	gal.	1.30 - 1.40	1.35 - 1.40	1.40 - 1.50
Refined, dr.	gal.	2.50 - 3.00	2.50 - 3.00	2.50 - 3.00
Glaubers salt, bags	cwt	1.00 - 1.15	1.00 - 1.10	1.20 - 1.40
Glycerine, c.p., drums, extra.	lb.	.25 - .26	.26 - .26¼	.24 - .25
Lead: White, basic carbonate, dry, casks	lb.	.09½-.....	.09½-.....	.10½-.....
White, basic sulphate, sck.	lb.	.09½-.....	.09½-.....	.09½-.....
Red, dry, sck.	lb.	.10 -.....	.10½-.....	.12 -.....
Lead acetate, white crys., bbl.	lb.	.13½- .14	.14½- .15	.14½-.....
Lead arsenate, powd., bbl.	lb.	.12 - .13	.14 - .15	.14 - .15
Lime, chem., bulk	ton	8.50 -.....	8.50 -.....	8.50 -.....
Litharge, pwd., csk.	lb.	.09 -.....	.10 -.....	.11½-.....
Lithopone, bags	lb.	.05½- .06	.05½- .06	.05½- .06½
Magnesium carb., tech., bags	lb.	.07½- .08	.07½- .08	.06 - .06½
Methanol, 95%, dr.	gal.	.83 - .85	.83 - .85	.55 - .58
97%, dr.	gal.	.85 - .90	.85 - .90	.57 - .62
Nickel salt, double, bbl.	lb.	.10 - .10½	.10 - .10½	.09 - .10
Single, bbl.	lb.	.10½- .11	.10½- .11	.10 - .11
Orange mineral, csk.	lb.	.12½-.....	.12½-.....	.14 -.....
Phosphorus, red, cases	lb.	.62 - .65	.62 - .65	.68 - .70
Yellow, cases	lb.	.32 - .33	.32 - .34	.34 - .36
Potassium bichromate, casks	lb.	.08½- .08¾	.08½- .08¾	.08¾- .08½
Carbonate, 80-85%, calc., csk.	lb	.05½- .06	.06 -.....	.06 - .06½
Chlorate, powd.	lb.	.08½- .09	.08½- .09	.08½- .09
Cyanide, cs	lb.	.55 - .57	.55 - .58	.55 - .57
First sorts, csk.	lb.	$0.09 -$0.09½	$0.08½-$0.09	$0.08½-$0.09
Hydroxide(c'stic potash)	dr.lb.	.07½- .07¾	.07½- .07¾	.07½- .07½
Muriate, 80% bgs.	ton	36.40 -.....	36.40 -.....	34.90 -.....
Nitrate, bbl.	lb.	.06 - .06½	.06 - .06½	.06 - .07¾
Permanganate, drums	lb.	.14 - .15	.14 - .15	.14¼- .15
Prussiate, yellow, casks	lb.	.18½- .19	.18½- .19	.18½- .19
Sal ammoniac, white, casks	lb.	.05½- .06	.05½- .06½	.05½- .06
Salsoda, bbl.	cwt.	.90 - .95	.90 - .95	.95 - 1.00
Salt cake, bulk	ton	17.00 -18.00	17.00 -18.00	17.00 -19.00
Soda ash, light, 58%, bags, contract	cwt.	1.32½-.....	1.32½-.....	1.38 -.....
Dense, bags	cwt.	1.37½-.....	1.37½- 1.55	1.45 - 1.55
Soda, caustic, 76%, solid, drums, contract	cwt.	3.00 -.....	3.00 -.....	3.10 -.....
Acetate, works, bbl.	lb.	.04½- .05¼	.04½- .05	.04½- .05
Bicarbonate, bbl.	cwt.	2.00 - 2.25	2.00 - 2.25	2.00 - 2.25
Bichromate, casks	lb.	.06¾- .06½	.06¾- .06½	.06½- .06¾
Bisulphate, bulk	ton	5.00 - 5.50	5.00 - 5.50	6.00 - 7.00
Bisulphite, bbl.	lb.	.03½- .04	.03½- .04	.03½- .04
Chlorate, kegs	lb.	.06½- .06¾	.06½- .06¾	.06½- .06¾
Chloride, tech.	ton	12.00 -14.75	12.00- 14.75	12.00 -14.00
Cyanide, cases, dom.	lb.	.18 - .22	.18 - .22	.19 - .22
Fluoride, bbl.	lb.	.08¾- .09	.09¼- .10	.08½- .09
Hyposulphite, bbl.	lb.	2.50 - 3.00	2.50 - 3.00	2.65 - 3.00
Nitrate, bags	cwt.	2.65 -.....	2 65 -.....	2.63 -.....
Nitrite, casks	lb.	.08 - .08½	.08 - .08½	.08½- .09
Phosphate, dibasic, bbl.	lb.	.03¼- .03¾	.03¼- .03¾	.03¾- .03¾
Prussiate, yel. drums	lb.	.12 - .12½	.12 - .12½	.10½- .10¾
Silicate (30°, drums)	cwt.	.75 - 1.15	.75 - 1.15	.75 - 1.15
Sulphide, fused, 60-62%	dr.lb.	.03½- .04	.03 - .03½	.02½- .03
Sulphite, crys., bbl.	lb.	.03 - .03¼	.03 - .03¾	.02½- .03
Strontium nitrate, bbl.	lb.	.08½- .09	.08½- .09	.08½- .09
Sulphur, crude at mine, bulk	ton	19.00 -.....	19.00 -.....	19.00 -20.00
Chloride, dr.	lb.	.04 - .05	.04 - .05	.05 - .05½
Dioxide, cyl.	lb.	.09 - .10	.09 - .10	.09 - .10
Flour, bag	cwt.	2.70 - 3.00	2.70 - 3.00	2.70 - 3.00
Tin bichloride, bbl.	lb.	.19½-.....	.19½-.....	.17½-.....
Oxide, bbl.	lb.	.70 -.....	.70 -.....	.66 -.....
Crystals, bbl.	lb.	.47 -.....	.47 -.....	.42½-.....
Zinc chloride, gran., bbl.	lb.	.06½- .06½	.06½- .06½	.07 - .07½
Carbonate, bbl.	lb.	.10 - .11	.10 - .10¾	.10½- .11
Cyanide, dr.	lb.	.40 - .41	.40 - .41	.40 - .41
Dust, bbl.	lb.	.10½- .11	.10½- .11	.09 - .10
Zinc oxide, lead free, bag.	lb.	.06½-.....	.06½-.....	.07½-.....
5% lead sulphate, bags	lb.	.06½-.....	.06½-.....	.07½-.....
Sulphate, bbl	cwt.	2.75 - 3.00	2.75 - 3.00	3.00 - 3.50

Oils and Fats

		Current Price	Last Month	Last Year
Castor oil, No. 3, bbl.	lb.	$0.13½-$0.14	$0.14 -$0.14½	$0.13 -$0.14
Chinawood oil, bbl.	lb.	.25 -.....	.30 - .32	.12 - .12½
Coconut oil, Ceylon, tanks, N. Y.	lb.	.08½-.....	.08½-.....	.10 -.....
Corn oil crude, tanks, (f.o.b. mill)	lb.	.07½-.....	.07½-.....	.12 -.....
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.07½-.....	.07½-.....	.12 -.....
Linseed oil, raw, car lots, bbl.	lb.	11.2 -.....	10.6 -.....	10.8 -.....
Palm, Lagos, casks	lb.	.07¾- .09	.07¾- .08	.08½-.....
Niger, casks	lb.	.07½-.....	.07½- .07¾	.08½-.....
Palm Kernel, bbl.	lb.	.09½-.....	.09½-.....	.09½- .10
Peanut oil, crude, tanks(mill)	lb.	.12 -.....	.12½-.....	.10 -.....
Perilla, bbl.	lb.	-.....	-.....	.14½-.....
Rapeseed oil, refined, bbl.	gal.	.80 - .82	.80 - .82	.90 - .92
Sesame, bbl.	lb.	-.....	-.....	-.....
Soya bean tank (f.o.b. Coast)	lb.	.09½-.....	.10 -.....	.10 -.....
Sulphur(olive foots), bbl.	lb	.09½-.....	.09½-.....	.08½-.....
Cod, Newfoundland, bbl.	gal.	.63 - .66	.63 - .64	.64 - .65
Menhaden, light pressed, bbl.	gal.	.60 - .62	.60 - .62	.69 - .71
Crude, tanks(f.o.b. factory)	gal.	-.....	-.....	-.....
Whale, crude, tanks	lb.	-.....	-.....	-.....
Grease, yellow, loose	lb.	.06½-.....	.06½-.....	.07½- .08½
Oleo stearine	lb.	.09½-.....	.09½-.....	.13 - .13½
Red oil, distilled, d.p. bbl.	lb.	.09½- .10	.09½- .10	.10 - .10½
Tallow, extra, loose	lb.	.07½-.....	.07½-.....	.08 -.....

Coal-Tar Products

		Current Price	Last Month	Last Year
Alpha-naphthol, crude, bbl.	lb.	$0.60 -$0.65	$0.60 -$0.65	$0.60 -$0.62
Refined, bbl.	lb.	.85 - .90	.85 - .90	.85 - .90
Alpha-naphthylamine, bbl.	lb.	.35 - .36	.35 - .36	.35 - .36
Aniline oil, drums, extra	lb.	.15 - .16	.15 - .16	.16 - .16½
Aniline salts, bbl.	lb.	.24 - .25	.24 - .25	.22 - .23
Anthracene, 80%, drums	lb.	.60 - .65	.60 - .65	.60 - .65
Benzaldehyde, U.S.P., dr.	lb.	1.15 - 1.25	1.15 - 1.35	1.30 - 1.35
Benzidine base, bbl.	lb.	.70 - .72	.70 - .75	.72 - .74
Benzoic acid, U.S.P., kgs.	lb.	.58 - .60	.58 - .60	.56 - .60
Benzyl chloride, tech, dr.	lb.	.25 - .26	.25 - .26	.25 - .26
Benzol, 90%, tanks, works	gal.	.24 - .25	.24 - .25	.24 - .25
Beta-naphthol, tech., drums	lb.	.22 - .24	.22 - .24	.22 - .24
Cresol, U.S.P., dr.	lb.	.18 - .20	.18 - .20	.18 - .20
Cresylic acid, 97%, dr., wks.	gal.	.61 - .62	.61 - .62	.60 - .65
Diethylaniline, dr.	lb.	.58 - .60	.58 - .60	.58 - .60
Dinitrophenol, bbl.	lb.	.31 - .35	.31 - .33	.31 - .35
Dinitrotoluen, bbl.	lb.	.17 - .18	.17 - .18	.18 - .20
Dip oil, 25% dr.	gal.	.28 - .30	.28 - .30	.28 - .30
Diphenylamine, bbl.	lb.	.45 - .47	.45 - .47	.48 - .50
H-acid, bbl.	lb.	.63 - .65	.63 - .65	.65 - .66

Coal-Tar Products—Continued

	Current Price	Last Month	Last Year
Naphthalene, flake, bbl. lb.	.04½ - .05	.05½ - .06	.06½ - .07
Nitrobenzene, dr. lb.	.09 - .10	.09 - .10	.09 - .10
Para-nitraniline, bbl. lb.	.52 - .53	.45 - .50	.50 - .53
Para-nitrotoluine, bbl. lb.	.28 - .32	.28 - .32½	.40 - .42
Phenol, U.S.P., drums lb.	.17 - .19	.17 - .19	.22 - .24
Picric acid, bbl. lb.	.30 - .40	.30 - .40	.25 - .26
Pyridine, dr. lb.	3.00 -.....	3.00 -.....	3.90 - 4.00
R-salt, bbl. lb.	.47 - .50	.40 - .44	.50 - .55
Resorcinal, tech, kegs. lb.	1.30 - 1.35	1.35 - 1.40	1.30 - 1.40
Salicylic acid, tech., bbl. lb.	.30 - .32	.30 - .32	.32 - .33
Solvent naphtha, w.w.,tanks gal.	.35 -.....	.35 -.....	.35 -.....
Tolidine, bbl. lb.	.95 - .95	.95 - .96	.90 - .95
Toluene, tanks, works gal.	.35 -.....	.35 -.....	.26 -.....
Xylene, com., tanks gal.	.36 - .41	.36 - .41	.36 - .40

Miscellaneous

	Current Price	Last Month	Last Year
Barytes, grd., white, bbl. ton	$23.00-$25.00	$23.00-$25.00	$20.00-$22.00
Casein, tech., bbl. lb.	.15 - .16	.15 - .16	.13½ - .14
China clay, dom.,f.o.b. mine ton	10.00 -20.00	10.00 -20.00	10.00 -20.00
Dry colors:			
Carbon gas, black (wks.) lb.	.08 - .08½	.08 - .08½	.08 - .08½
Prussian blue, bbl. lb.	.33 - .34	.33 - .34	.32 - .33
Ultramine blue, bbl. lb.	.08 - .35	.08 - .35	.08 - .35
Chrome green, bbl. lb.	.27 - .31	.28 - .30	.28 - .30
Carmine red, tins lb.	5.00 - 5.10	5.00 - 5.10	5.10 - 5.35
Para toner lb.	.80 - .90	.80 - .90	.90 - .95
Vermilion, English, bbl. lb.	1.50 - 1.55	1.50 - 1.55	1.45 - 1.50
Chrome yellow, C. P., bbl lb.	.17 - .18	.17½ - .18	.17½ - .18
Feldspar, No. 1 (f.o.b. N. C.) ton	6.50 - 7.00	6.50 - 7.00	6.00 - 6.50
Graphite, Ceylon, lump, bbl lb.	.08 - .09	.07 - .09½	.09 - .10
Gum copal, Congo, bags lb.	.09½ - .10	.09½ - .10	.09½ - .10
Manila, bags lb.	.15 - .18	.15 - .16	.14 - .16
Damar, Batavia, cases lb.	.25 - .25½	.25 - .26	.25 - .25½
Kauri, No. 1 cases lb.	.55 - .57	.55 - .57	.58 - .62
Kieselguhr (f.o.b. N. Y.) ton	50.00 -55.00	50.00 -55.00	50.00 -55.00
Magnesite, calc. ton	44.00 -.....	44.00 -.....	38.00 -42.00
Pumice stone, lump, bbl. lb.	.05 - .07	.05 - .08	.04½ - .06
Imported, casks lb.	.03 - .40	.03 - .40	.03 - .35
Rosin, H. bbl.	10.85 -.....	11.00 -.....	12.50 -.....
Turpentine gal.	.62 -.....	.68 -.....	.88 -.....
Shellac, orange, fine, bags lb.	.38 - .39	.47 - .48	.40 - .41
Bleached, bonedry, bags lb.	.47 - .50	.50 - .52	.43 - .44
T. N. bags lb.	.37 - .38	.42 - .44	.32 - .34
Soapstone (f.o.b. Vt.), bags ton	10.00 -12.00	10.00 -12.00	9.00 -11.00
Talc, 200 mesh (f.o.b. Vt.) ton	11.00 -.....	11.00 -.....	10.50 -.....
200 mesh (f.o.b. Ga.) ton	7.50 -10.00	7.50 -10.00	7.50 -11.00
325 mesh (f.o.b. N. Y.) ton	14.75 -.....	14.75 -.....	14.75 -.....
Wax, Bayberry, bbl. lb.	.25 - .26	.25 - .26	.20 - .21
Beeswax, ref., light lb.	.45 - .46	.45 - .47	.46 - .47
Candelilla, bags lb.	.33 - .34	.34 - .35	.36 - .37
Carnauba, No. 1, bags lb.	.65 - .70	.70 - .72	.48 - .50
Paraffine, crude 105-110 m.p. lb.	.05½ - .06	.06 - .06½	.05½ - .06

Ferro-Alloys

	Current Price	Last Month	Last Year
Ferrotitanium, 15-18% ton	$200.00-.....	$200.00-.....	$200.00-.....
Ferrochromium, 1-2% lb.	.23- .25	.23- .35	.23-
Ferromanganese, 78-82% ton	100.00-.....	88.00-90.00	88.00-90.00
Spiegeleisen, 19-21% ton	36.00-37.00	36.00-37.00	33.00-34.00
Ferrosilicon, 10-12% ton	33.00-38.00	33.00-38.00	33.00-38.00
Ferrotungsten, 70-80% lb.	.98- 1.03	1.00- 1.05	1.10- 1.15
Ferro-uranium, 35-50% lb.	4.50-.....	4.50-.....	4.50-.....
Ferrovanadium, 30-40% lb.	3.15- 3.75	3.25- 4.00	3.25- 3.75

Non-Ferrous Metals

	Current Price	Last Month	Last Year
Copper, electrolytic lb.	$0.13 -.....	$0.13 -.....	$0.14½-$0.14½
Aluminum, 96-99% lb.	.26 - .28	.26 - .27	.27 - .28
Antimony, Chin. and Jap. lb.	.12 - .12½	.14½-.....	.19½-.....
Nickel, 99% lb.	.35 -.....	.35 -.....	.34 -.....
Monel metal, blocks lb.	.32 - .33	.32 - .33	.32 - .33
Tin, 5-ton lots, Straits lb.	.67½-.....	.68 -.....	.62½-.....
Lead, New York, spot lb.	7.15 -.....	7.65 -.....	8.20 -.....
Zinc, New York, spot lb.	6.40 -.....	6.72½-.....	.08 -.....
Silver, commercial oz.	.56½-.....	.56½-.....	.65½-.....
Cadmium lb.	.60 -.....	.60 -.....	.60 -.....
Bismuth, ton lots lb.	2.20 - 2.25	2.70 - 2.75	2.70 - 2.75
Cobalt lb.	2.50 -.....	2.50 -.....	2.50 - 3.00
Magnesium, ingots, 99% lb.	.75 - .80	.75 - .80	.75 - .80
Platinum, ref. oz.	86.00-.....	108.00-.....	112.00-.....
Palladium, ref. oz.	59.00- 63.00	68.00- 69.00	78.00-.....
Mercury, flask..75 lb.	126.00-.....	104.00-.....	87.50-.....
Tungsten powder lb.	1.05- 1.15	1.05-.....	1.18-.....

Ores and Semi-finished Products

	Current Price	Last Month	Last Year
Bauxite, crushed, wks. ton	$5.50- $8.50	$5.50- $8.50	$5.50- $8.75
Chrome ore, c.f. post ton	21.00- 24.00	21.00- 24.00	22.00- 23.00
Coke, fdry., f.o.b. ovens ton	3.75- 4.25	3.75- 4.25	3.75- 4.25
Fluorspar, gravel, f.o.b. Ill. ton	18.00-.....	18.00-.....	18.00-.....
Ilmenite, 52% TiO_2, Va. lb.	.0½- .0¾	.0¾ - .0¾	.01½-.....
Manganese ore, 50% Mn., c.i.f. Atlantic Ports unit	.36 - .38	.36 - .38	.40 - .42
Molybdenite, 85% MoS_2 per lb. MoS_2, N. Y. lb.	.48 - .50	.48 - .50	.65- .70
Monazite, 6% of ThO_2 ton	120.00-.....	120.00-.....	120.00-.....
Pyrites, Span. fines, c.i.f. unit	.13½-.....	.13½-.....	.13½-.....
Rutile, 94-96% TiO_2 lb.	.11 - .13	.11 - .13	.12 - .15
Tungsten, scheelite, 60% WO_3 and over unit	11.25 -11.50	11.25 -11.50	12.50 -13.00
Vanadium ore, per lb. V_2O_5 lb.	.25 - .28	.25 - .30	.30 - .35
Zircon, 99% lb.	.03 -.....	.03 -.....	.03 -.....

Current Industrial Developments

New Construction and Machinery Requirements

Absorption Plant—Petroleum Securities Co., 1006 Petroleum Securities Bldg., Los Angeles, Calif., will build an absorption plant on East 3rd St., Long Beach, Calif., by day labor. Estimated cost $18,000.

Absorption Gasoline Plant—Maupin & Burnett, Amarillo, Tex., will soon receive bids for the construction of an absorption gasoline plant, 3 units, 36,000 gal. daily capacity. Estimated cost $150,000. Private plans.

Acetylene—Oxweld Acetylene Co., 646 Frelinghuysen Ave., Newark, N. J., awarded contract for the construction of a 3 story, 80 x 200 ft. acetylene plant to J. W. Ferguson Co., Inc., 152 Market St., Paterson, N. J. Estimated cost $150,000.

Aluminum Factory—Kewaskum Aluminum Co., A. L. Rosenheimer, Pres., Kewaskum, Wis., is having plans prepared for the construction of a 2 story, 50 x 80 ft. aluminum factory. Estimated cost $40,000. Private plans.

Antitoxin Building—Eli Lilly Co., McCarthy and Delaware Sts., Indianapolis, Ind., awarded contract for the construction of a 1 story 80 x 120 ft. antitoxin building near Greenfield, Ind., to A. V. Stackhouse, 2611 Cornell Ave., Indianapolis, Ind. Estimated cost $44,000.

Bronze Foundry—The John Harsch Bronze Foundry Co., H. R. Harsch, Treas. and Gen. Mgr., 11612 Madison Ave., Cleveland, O., awarded contract for the construction of a 2 story, 60 x 70 ft. addition to bronze foundry, to Boldt Construction Co., 1969 East 70th St., Cleveland. Estimated cost $40,000.

Candy Factory—Martha Washington Candies Co., E. Sheetz, Pres., 1601 Connecticut Ave., Washington, D. C., plans the construction of a 2 story, 80 x 135 ft. candy factory at Robert Gillham Rd. and Linwood Blvd., Kansas City, Mo. Estimated cost to exceed $40,000. Hoit, Price & Barnes, 800 Davidson Bldg., Kansas City, Mo., are architects.

Canning Plant—Western Canners Maritime Ltd., St. John, N. B., plans the construction of a canning plant. Estimated cost $200,000. Complete machinery and equipment will be required.

Carbon Black Plant—Magnolia Petroleum Co., Amarillo, Tex., is having preliminary plans prepared for the construction of a carbon black plant, two units of 36 burners each, 15,000,000 ft. daily capacity near Shamrock, Tex. Estimated cost $150,000. Private plans.

Carbonizer Mill—W. Spink, River Rd. Manayunk, Philadelphia, Pa., awarded contract for the construction of a 3 story, 23 x 108 and 30 x 75 ft. carbonizer mill at Flat Rock Rd. and Leverington St., to H. T. Brown, Young and Essex Sts., Woodlyn, Pa.

Cement Plant—Lime Products Co., A. B. Banks, Pres., Home Insurance Bldg., Little Rock, Ark., is having preliminary plans prepared for the construction of a plant for the manufacture of portland cement at White Cliffs, Ark. Estimated cost $500,000. A. M. Lund, Home Insurance Bldg., Little Rock, Ark., is engineer.

Cement Plant—N. W. Mathey, Willow St., Lynn, Mass., awarded contract for the construction of a 1 story, 55 x 100 ft. cement plant at Saugus, Mass. to J. F. Tirrell, 40 Adams Ave., Saugus, Mass.

Cement Plant—Monterey Bublestone Co., Santa Barbara, Calif., plans the construction of a factory for the manufacture of a by-product from cement similar to brick but of a lighter material. Estimated cost including equipment $40,000. Private plans.

Chemical Plant—Thames Color & Chemical Co., Broad St., New London, Conn., awarded contract for the construction of a 1 story, 40 x 60 ft. chemical plant to J. L. Aitchison, 19 Brook St., New London, Conn.

Clay Drying Plant—Brockway Clay Co., Brockway, Pa., will build a 4 story, 90 x 120 ft. clay drying plant. Estimated cost $50,000. Private plans. Work will be done by separate contracts.

Clay Products Mill—Cape Silica Co., c/o J. W. Ford, Kankanee, Ill., plans the construction of a clay products mill at Cape Girardeau, Mo. Estimated cost $80,000. E. H. Stroud & Co., 928 Fullerton St., Chicago, Ill., are engineers. Machinery and equipment will be required.

Coal and Gas Plant—Pawtucket Gas Co., F. W. Easton, Pres., Pawtucket, R. I., will build a coal and gas plant. Work will be done under the supervision of Stone & Webster, 147 Milk St., Boston, Mass., Engrs.

Compressed Gas Plants—Linde Air Products Co. and Prest-O-Lite Co., subsidiaries of the Union Carbide and Carbon Corp., 30 East 42nd St., New York, N. Y., have acquired a site and plans the construction of two compressed gas plants at 39th Ave. and Oneota St., Duluth, Minn. Total estimated cost $500,000, also one at Amarillo, Tex. Estimated cost $150,000.

Compression Plant—P. S. Powell & Associates, Gunter Bldg., San Antonio, Tex.,

will soon award contract for the construction of a compression plant for the recovery of natural gasoline from gas, 7,000 gal. daily capacity. Estimated cost $500,000. Private plans.

Compress and Fumigation Plant—Fabens Compress & Fumigation Co., H. Krupp, Fabens, Tex., is having plans prepared for the construction of a compress and fumigation plant, probably electrically operated. Estimated cost $100,000. Private plans.

Copper Concentrating Plant—The Canadian-American Copper Refining Co., Montreal, Que., will soon receive bids for the construction of a copper concentrating plant at Eastman, Que. Estimated cost $300,000.

Drug & Chemical Plant—McKesson-Robbins, Inc., c/o Fletcher-Thompson Inc., 542 Fairfield Ave., Bridgeport, Conn., Archts., awarded contract for the construction of a 5 story, 80 x 200 ft. drug and chemical plant at Fairfield, Conn. to T. J. Pardy Construction Co., 1481 Seaview Ave., Bridgeport, Conn.

Dry House, Etc.—The Brunsene Co., L. T. Sawyer, Stanley Ave., Watertown, Mass., awarded contract for the construction of a 1 story dry house and fan room to Sawyer Construction Co., 16 Arlington St., Boston, Mass. Estimated cost $50,000.

Fertilizing Plant—Cudahy Packing Co., Kansas Ave., Kansas City, Kan., will award contract for the construction of a 4 story fertilizing plant. Estimated cost $100,000. Private plans.

Gas Plant—Skelly Oil Co., Skelly Bldg., Tulsa, Okla., is having plans prepared for the construction of a natural gas plant, 20,000,000 cu.ft. capacity in Panhandle Section, Tex. Estimated cost $2,000,000. Private plans.

Gas (Coal) Plant—Pawtucket Gas Co., Pawtucket, R. I., will build a 3 story, 30 x 57 ft. addition to coal gas plant by day labor at Tidewater plant. Estimated cost $175,000. W. T. Sturtevant, c/o owner, is architect.

Gas Products Plant—The Gas Products Co., S. D. Winger, V. Pres. and Gen. Mgr., 100 North Skidmore St., Columbus, O., will soon award contract for the construction of a 1 story gas products plant on Jennings Rd., Cleveland, O. Estimated cost $60,000. Private plans.

Gasoline Plant—Magnolia Petroleum Co., Beaumont, Tex., had preliminary plans prepared for the construction of a casinghead gasoline plant at Chandler, Okla. Estimated cost $35,000. Private plans. Two gas engines and compressors will be required.

Glass Plant—American Window Glass Co., Farmers Bank Bldg., Pittsburgh, Pa., awarded contract for extensions and improvements to glass plant at Belle Vernon, Pa., to Bollinger Andrews Construction Co., Empire Bldg., Pittsburgh, Pa. Estimated cost $300,000. Modern machinery for flat glass production will be required.

Glass Plant—Gill Glass Co., Amber and Vanango Sts., Philadelphia, Pa., plans the construction of a 2 story, 150 x 250 ft., glass plant. Estimated cost $200,000. I. T. Catharine, Frankling Trust Bldg., Philadelphia, Pa., is architect.

Glass Plant—Ohio Window Glass Co., J. Unger, Mgr., 4045 St. Clair Ave., Cleveland, O., awarded contract for the construction of a 2 story, 35 x 75 ft. glass plant, to R. Hansen Construction Co., 2952 Litchfield Rd., Cleveland, O. Estimated cost $40,000.

Graphite Mill—Southwestern Graphite Mines, Burnet, Tex., awarded contract for the construction of a new graphite mill to replace one recently destroyed by fire, to Southwestern Engineering Corp., Hollingsworth Bldg., Los Angeles, Calif. Estimated cost including equipment $300,000.

Heat Resisting Plant—F. B. Lincoln, Pres. of Lincoln Engineering Corp., et al, Riverside, Conn., plan the construction of a plant for the manufacture of heat resisting materials at 16th and Avery Sts., Louisville, Ky. Estimated cost $2,000,000. Architect and engineer not selected.

Insulated Copper Wire Plant—Belden Mfg. Co., Richmond, Ind., awarded contract for the construction of an insulated copper wire plant, to J. Mueller, Richmond, Ind. Estimated cost $205,000. Private plans.

Laboratory—Dept. of Health, Capitol, Albany, N. Y., will receive bids in June for the construction of a laboratory. S. W. Jones, Capitol, Albany, N. Y., is state architect.

Laboratory—St. Louis College of Pharmacy, 2108 Locust St., St. Louis, Mo., will soon award contract for the construction of a 5 story, 75 x 100 ft. college including laboratory, etc. at Euclid St. and Parkview Pl. Estimated cost $200,000. W. B. Ittner, 911 Locust St., St. Louis, Mo., is architect.

Laboratory—Wisconsin Steel Works, 2701 East 106th St., Chicago, Ill., awarded contract for the construction of a 40 x 60 ft. laboratory, etc. at 106th St. and Torrence Ave. Estimated cost $40,000.

Laboratory—Yale University, New Haven, Conn., will soon award contract for the construction of a 4 story, 200 x 250 ft. laboratory at Congress and Cedar Sts. Estimated cost $800,000. H. C. Pelton, 415 Lexington Ave., New York, N. Y., is architect.

Laboratory Addition—Standard Oil Co., Bayway Refinery, Elizabeth, N. J., had plans prepared for the construction of a 1 story, 50 x 65 ft. addition to laboratory. Estimated cost $40,000. Private plans.

Laboratory (Biological)—Wesleyan University, Middletown, Conn., awarded contract for the construction of a 2 story, 55 x 125 ft. biological laboratory, to H. Wales Lines Co., 134 State St., Meriden, Conn.

Laboratory (Chemical)—Schlotterbeck & Foos Co., 36 Brown St., Portland, Me., awarded contract for the construction of a 5 story, 60 x 100 ft. chemical laboratory, to Morton C. Tuttle Co., 862 Park Sq. Bldg., Boston, Mass.

Laboratories (Chemistry and Engineering)—Princeton University, G. C. Wintringer, Supt., Princeton, N. J., awarded contract for the construction of a 3 story, 200 x 200 ft. chemistry laboratory, also a 3 story engineering laboratory. Estimated cost $1,000,000 and $250,000 respectively.

Leather Factory—Strauss-Limon Leather Co., 34 Walnut St., Peabody, Mass., awarded contract for the construction of a 3 story, 50 x 140 ft. factory to E. H. Porter Co., 13 Wallis St., Peabody, Mass.

Leather Factory Addition—F. C. Stuart, 292 Broad St., Lynn, Mass., awarded contract for the construction of a 3 story addition to leather factory to C. H. Cunningham & Sons Co., 23 Central Ave., Lynn, Mass.

Licorice Plant—National Licorice Co., 106 Johns St., Brooklyn, N. Y., awarded contract for the construction of a 4 story, 137 x 144 ft. plant at 13th and Washington Sts., Philadelphia, Pa., to Wm. Steele & Son, 15th and Cherry Sts., Philadelphia, Pa.

Lime Plant—Hoosac Valley Lime Co., W. F. Fisherty, Pres., Howland Ave., Adams, Mass., awarded contract for the construction of a lime plant including lime kilns to increase the capacity 1,000 bbls. daily, to Traylor Engineering & Mfg. Co., Allentown, Pa. Estimated cost to exceed $40,000.

Magnesia Factory—New England Magnesia Co., 84 Leverett St., Boston, Mass., is receiving bids for the construction of a 2 story, 45 x 200 ft. magnesia factory at Roxbury, Mass. Estimated cost $50,000. Miller & Levi, 46 Cornhill, Boston, Mass., are architects.

Milk (Condensed) Plant—Petroleum Milk Co., Arcade Bldg., St. Louis, Mo., will build a 1 and 2 story, 185 x 265 ft. milk condensed plant at Neosho, Mo. by day labor. Estimated cost $250,000. Helfensteller, Hirsch & Watson, Chemical Bldg., St. Louis, Mo., are architects. C. H. Hug, Supt., in charge of construction.

Oils, Paints, Pigments, etc.—Stores Control Board, Auckland, N. Z., will receive bids until June 30 for oils, paints, pigments, varnishes, etc., for periods of 1, 2 and 3 years.

Paper Mill—De Pere Paper Mfg. Co., H. Miller, Howard St., De Pere, Wis., is receiving bids for the construction of a 1 story, 60 x 150 ft. paper mill. Estimated cost $40,000. Private plans.

Paper Mill—C. H. Dexter & Sons, Windsor Locks, Conn., awarded contract for the construction of a 4 story, 60 x 150 ft. paper mill to R. G. Bent Co., 93 Edwards St., Hartford. Estimated cost $100,000.

Paper Mill—Nicollet Paper Co., c/o H. C. Hanke, De Pere, Wis., is having plans prepared for the construction of a 1 story, 60 x 90 ft., paper mill. Estimated cost $40,000. Private plans.

Paper Mill—Tennessee Extract Co., 63rd Ave.,, Nashville, Tenn., manufacturers of an acid from wood, plans the construction of a paper mill. Estimated cost $500,000.

Paper Board Mill—Canada Paper Board Co., 520 King St. W., Toronto, Ont., plans the construction of a paper board mill at London, Ont. Estimated cost $200,000.

Paper Plant—Dennison Mfg. Co., Framingham, Mass., awarded contract for the construction of a 5 story, 70 x 105 ft. paper plant at Marlboro, Mass. to Morton C. Tuttle Co., 862 Park Sq. Bldg., Boston, Mass. Estimated cost $100,000.

Pasteurizing Plant—Borden Farm Products Co., Inc., 100 Hudson St., New York, N. Y., will soon award contract for the construction of a 2 story, 160 x 360 and 30 x 90 ft. pasteurizing plant at Orange and Nesbitt Sts., Newark, N. J. Estimated cost $1,000,000. W. E. Lehman, 972 Broad St., Newark, N. J., is architect.

Pigment Plant—R. H. Monk of McArthur-Irwin Ltd., 20 St. Paul St., Montreal, Que., will soon award contract for the construction of a plant for the manufacture of "Titanian White" a new pigment to be used in the same way as white lead.

Printing Ink Factory—O'Brien Printing Ink Co., 35 South St. Clair St., Dayton, O., plans the construction of a 4 story factory for manufacture of printing inks, etc., at Second and Webster Sts. Estimated cost $150,000. Architect not selected.

Pulp & Paper Mill—Hawley Paper & Pulp Co., Oregon City, Ore., is having plans prepared for the construction of a pulp and paper mill. Estimated cost $1,500,000. V. D. Simonson, Tribune Tower Bldg., Chicago, Ill., is engineer.

Pulpwood Plant—A. Tremblay, Bagotville, Que., will soon receive bids for the construction of a pulpwood plant at St. Felicien, Que. Estimated cost $300,000.

Refinery—San Angelo Refining Co., W. B. Hassett, Pres., 112 East 27th St., Tulsa, Okla., will build an addition to refinery, and install crude stills and tankage at San Angelo, Tex. Estimated cost $25,000. Work will be done by day labor.

Refinery—Stribling & Travis, Sweetwater, Tex., have acquired the Sweetwater refinery and will construct into a modern plant. Estimated cost $50,000. Private plans. Some machinery will be purchased.

Refinery—San Angelo Refining Co., San Angelo, Tex., plans extensions and improvements to refinery, installation of additional machinery and equipment to triple present output. Estimated cost $75,000. Private plans. Work will be done by owners forces.

Refinery (Oil)—Empire Refinery Co., Ponca City, Okla., plans extensions and improvements to oil refinery including four new high pressure cracking stills and motorizing all equipment. Estimated cost $1,000,000. R. R. Mills, Ponca City, Okla., is engineer.

Refinery (Oil)—Grayburg Oil Co., F. L. Thompson, Maverick Bldg., San Antonio, Tex., is having plans prepared for the construction of an oil refinery at Somerset, Tex. Estimated cost $500,000. Private plans. Machinery and equipment will be required.

Refinery (Oil)—The Yorkton Oil & Refining Co., c/o W. T. Ross, Gen. Mgr., of Irro Gas & Oil Co. Ltd., Saskatoon, Sask., plans the construction of an oil refinery. Estimated cost $300,000.

Refinery (Oil and Gasoline)—F. E. Smith & Associates, Camden, Ark., plans the construction of an oil and gasoline refinery probably at Big Lake, Tex. Estimated cost $500,000. Private plans. Plant to be equipped with latest type of machinery.

Refractories—Seaboard Refractories Co., Vanentines Ave., Perth Amboy, N. J., is having plans prepared for the construction of 40 x 60 and 80 x 300 ft. refractories. Estimated cost $150,000.

Rubber (Scrap) Factory—A. Lowenstein, 110 Lillie St., Newark, N. J., awarded contract for the construction of a 1 story, 100 x 125 ft. scrap rubber factory, to A. Pastore, 237 Bigelow St., Newark, N. J. Estimated cost $40,000.

Soap Factory—Scholler Bros., Amber and Westmoreland Sts., Philadelphia, Pa., have acquired a site and plans the construction of a factory for the manufacture of textile soaps and compounds at St. Catharines, Ont.

Soap Factory—Royal Crown Soap Co., 308 Georgia St. E., Vancouver, B. C., will receive bids about June 16 for the construction of a 2 or 3 story, 50 x 100 ft. addition to soap factory. Estimated cost $75,000. Hodgson & Simmonds, 320 Province Bldg., Vancouver, B. C., are architects.

Syrup Factory—Pacific Coast Syrup Co., 731 Sansome St., San Francisco, Calif., awarded contract for the construction of a 6 story syrup factory on Sansome St., to P. J. Walker Co., Sharon Bldg., San Francisco, Calif. Estimated cost $250,000.

Varnish Factory—Keystone Varnish Co., 61 Otsego St., Brooklyn, N. Y., awarded contract for the construction of a 5 story varnish factory, to E. F. Carlson Co., 393 7th Ave., New York, N. Y. Estimated cost $150,000.